



**SNOWPLOWS**

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# **MECHANIC'S GUIDE**



## **SNOWPLOWS**

Featuring the  
**Insta-Act® Hydraulic System**  
**Isolation Module Light System**

**⚠ CAUTION**

Read this manual before servicing the snowplow.



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## INTRODUCTION

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This guide has been prepared to assist the trained mechanic in the service of FISHER® snowplows. It also provides safety information and recommendations. We urge all mechanics to read this manual carefully before attempting to service the FISHER snowplow equipment covered by this guide.

Service of your FISHER snowplow equipment is best performed by your local FISHER products outlet. They know your snowplow best and are interested in your complete satisfaction.

### RECOMMENDED TOOLS

- Long, slender needle nose pliers
- Flat screwdriver
- Sockets and combination wrenches: 5/16"–7/8", 1-1/16", 1-1/8"
- Deep socket: 7/8"
- 10 mm socket
- 1/4" socket or nut driver
- 12V test light
- Torque wrench (in-lb/ft-lb)
- Allen wrench set
- 600 psi pressure gauge w/adapter fittings
- 3000 psi pressure gauge w/adapter fittings
- Flashlight
- Pick set

### AVAILABLE SERVICE ITEMS

- Isolation module tester (PN 26470-2)
- Removable spring tool (for replacing trip springs; PN 20043-1)
- Hydraulic pressure test kit (PN 56686)
- Multiplexed hydraulic diagnostic harness (PN 29290-2)
- Motor bearing sleeve repair kit (PN 64589)
- Pump shaft seal repair kit (PN 28856)

# SAFETY

## SAFETY DEFINITIONS

### ⚠️ WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious personal injury.

### ⚠️ CAUTION

Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

**NOTE:** Indicates a situation or action that can lead to damage to your snowplow and vehicle or other property. Other useful information can also be described.

## WARNING/CAUTION AND INSTRUCTION LABELS

Become familiar with and inform users about the warning and instruction labels on the back of the blade.

**NOTE:** If labels are missing or cannot be read, see your sales outlet.

### Instruction Label

ATTACH

1. Pull Pin Release Handle to pull out Connecting Pins.
2. Drive vehicle slowly to engage Pushplates into Attachment Arms.
3. Attach all electrical connectors. With ignition in "ON" position, turn ON control and place in Lower/Float.
4. Stand in front of blade. Fully raise Pin Release Handle to release Connecting Pins.
5. Using the Headgear Push Bar, push Headgear toward vehicle to allow Connecting Pins to fully engage Pushplates.
6. Pull and hold Jack Lock out. Use Jack Handle to raise Jack fully and release Jack Lock. Repeat on opposite side.

DETACH

H.P. SERIES INSTRUCTIONS

Read Owner's Manual for complete instructions.

1. Place control in Lower/Float to put blade down.
2. Pull and hold Jack Lock out. Lower Jack until it contacts the ground, release Jack Lock. Verify Jack is locked by trying to lift Jack. Repeat on opposite side.
3. Stand in front of blade. While pushing the Headgear Push Bar toward the vehicle with left hand, pull Pin Release Handle to disengage Connecting Pins. Make sure Connecting Pins are fully retracted.
4. Detach all electrical connectors.

U.S. patents 6,944,976; 7,400,058; 7,430,621; 7,681,334; 7,737,076; 7,797,859; CAN patents 2,356,036; 2,632,102; and other patents pending.

### Warning and Caution Label

### ⚠️ WARNING

Lower blade when vehicle is parked.

Do not exceed GVWR or GAWR including blade and ballast.

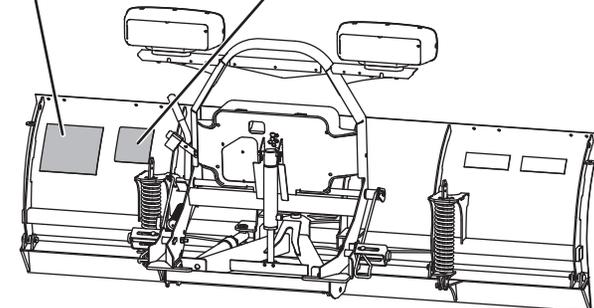
### ⚠️ CAUTION

Read Owner's Manual before operating or servicing snowplow.

Transport speed should not exceed 45 mph (72 km/h). Further reduce speed under adverse travel conditions.

Plowing speed should not exceed 10 mph (16 km/h).

See your sales outlet/Web site for specific vehicle application recommendations.



# SAFETY

## SAFETY PRECAUTIONS

Improper installation and operation could cause personal injury, and/or equipment and property damage. Read and understand labels and the Owner's Manual before installing, operating, or making adjustments.

### WARNING

Lower the blade when the vehicle is parked. Temperature changes could change hydraulic pressure, causing the blade to drop unexpectedly or damaging hydraulic components. Failure to do this could result in serious personal injury.

### WARNING

The driver shall keep bystanders clear of the blade when it is being raised, lowered, or angled. Do not stand between vehicle and blade or within 8 feet of a moving blade. A moving or falling blade could cause personal injury.

### WARNING

Keep hands and feet clear of the blade and A-frame when mounting or removing the snowplow. Moving or falling assemblies could cause personal injury.

### WARNING

Do not exceed GVWR or GAWR including blade and ballast. The rating label is found on driver-side vehicle door cornerpost.

### WARNING

To prevent accidental movement of the blade, always turn the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

### WARNING

Remove blade assembly before placing vehicle on hoist.

### CAUTION

Refer to the current eMatch selection system for minimum vehicle recommendations and ballast requirements.

## HYDRAULIC SAFETY

### WARNING

Hydraulic fluid under pressure can cause skin injection injury. If you are injured by hydraulic fluid, get medical attention immediately.

- Always inspect hydraulic components and hoses before using. Replace any damaged or worn parts immediately.
- If you suspect a hose leak, DO NOT use your hand to locate it. Use a piece of cardboard or wood.

## FUSES

The electrical and hydraulic systems contain several automotive-style fuses. If a problem should occur and fuse replacement is necessary, the replacement fuse must be of the same type and amperage rating as the original. Installing a fuse with a higher rating can damage the system and could start a fire. Fuse Replacement, including fuse ratings and locations, is located in the Maintenance section of the Owner's Manual.

## PERSONAL SAFETY

- Remove ignition key and put the vehicle in PARK or in gear to prevent others from starting the vehicle during installation or service.
- Wear only snug-fitting clothing while working on your vehicle or snowplow.
- Do not wear jewelry or a necktie, and secure long hair.
- Wear safety goggles to protect your eyes from battery acid, gasoline, dirt, and dust.
- Avoid touching hot surfaces such as the engine, radiator, hoses, and exhaust pipes.
- Always have a fire extinguisher rated BC handy, for flammable liquids and electrical fires.

# SAFETY

## FIRE AND EXPLOSION

### ⚠ WARNING

Gasoline is highly flammable and gasoline vapor is explosive. Never smoke while working on vehicle. Keep all open flames away from gasoline tank and lines. Wipe up any spilled gasoline immediately.

Be careful when using gasoline. Do not use gasoline to clean parts. Store only in approved containers away from sources of heat or flame.

## CELL PHONES

A driver's first responsibility is the safe operation of the vehicle. The most important thing you can do to prevent a crash is to avoid distractions and pay attention to the road. Wait until it is safe to operate Mobile Communication Equipment such as cell phones, text messaging devices, pagers, or two-way radios.

## VENTILATION

### ⚠ WARNING

Vehicle exhaust contains lethal fumes. Breathing these fumes, even in low concentrations, can cause death. Never operate a vehicle in an enclosed area without venting exhaust to the outside.

## BATTERY SAFETY

### ⚠ CAUTION

Batteries normally produce explosive gases, which can cause personal injury. Therefore, do not allow flames, sparks, or lit tobacco to come near the battery. When charging or working near a battery, always cover your face and protect your eyes, and also provide ventilation.

- Batteries contain sulfuric acid, which burns skin, eyes, and clothing.
- Disconnect the battery before removing or replacing any electrical components.

## NOISE

Airborne noise emission during use is below 70 dB(A) for the snowplow operator.

## VIBRATION

Operating snowplow vibration does not exceed 2.5 m/s<sup>2</sup> to the hand-arm or 0.5 m/s<sup>2</sup> to the whole body.

## TORQUE CHART

### ⚠ CAUTION

Read instructions before assembling. Fasteners should be finger tight until instructed to tighten according to torque chart. Use standard methods and practices when attaching snowplow, including proper personal protective safety equipment.

Recommended Fastener Torque Chart					
Inch Fasteners Grade 5 and Grade 8					
Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Grade 5	 Grade 8		 Grade 5	 Grade 8
1/4-20	8.4	11.9	9/16-12	109	154
1/4-28	9.7	13.7	9/16-18	121	171
5/16-18	17.4	24.6	5/8-11	150	212
5/16-24	19.2	27.3	5/8-18	170	240
3/8-16	30.8	43.6	3/4-10	269	376
3/8-24	35.0	49.4	3/4-16	297	420
7/16-14	49.4	69.8	7/8-9	429	606
7/16-20	55.2	77.9	7/8-14	474	669
1/2-13	75.3	106.4	1-8	644	909
1/2-20	85.0	120.0	1-12	704	995
Metric Fasteners Class 8.8 and 10.9					
Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Class 8.8	 Class 10.9		 Class 8.8	 Class 10.9
M6 x 1.00	7.7	11.1	M20 x 2.50	325	450
M8 x 1.25	19.5	26.9	M22 x 2.50	428	613
M10 x 1.50	38.5	53.3	M24 x 3.00	562	778
M12 x 1.75	67	93	M27 x 3.00	796	1139
M14 x 2.00	107	148	M30 x 3.50	1117	1545
M16 x 2.00	167	231	M33 x 3.50	1468	2101
M18 x 2.50	222	318	M36 x 4.00	1952	2701
These torque values apply to fasteners except those noted in the instructions.					

# SPECIFICATIONS

## HT Series™ Insta-Act® HYDRAULIC SYSTEM SPECIFICATIONS

### ⚠ CAUTION

Do not mix different kinds of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.

**NOTE:** Remove breather/fill plug slowly to relieve any pressure in reservoir.

### Hydraulic Fluid

- FISHER® EZ Flow Hydraulic Fluid to –40°F (–40°C) or other fluid conforming to Military Specification MIL-H-5606A, such as Mobil Aero HFA or Shell AeroShell® Fluid 4.

### Fluid Capacity

- Unit Reservoir = 1-1/2 quarts
- System Total = 2-1/4 quarts

Solenoid Valve Spool Travel = 0.07" for 3- and 4-way valves (S2, S3). Travel of 2-way valve (S1) spool is not detectable with voltage applied to coil.

### Electrical System – approx. values:

- Solenoid Coil Resistance = 7 ohm at room temperature
- Solenoid Coil Amperage Draw = 1.5A
- Motor Relay Coil Resistance = 16–17 ohm
- Motor Relay Amperage Draw = 0.7A
- Motor Amperage Draw = 100A at 1650 psi ± 50 psi
- Switched Accessory Lead Draw = 0.75A

### 3-Port Module

#### Vehicle Control Harness Fuse Size

- Park/Turn – 10A (Mini)
- Control – 10A (Mini)

### 4-Port Module

#### (automotive-style)

- Park/Turn – 15A
- Control – 7.5A

### Fastener Torque

Pump Cap Screws	5/16-18 x 2	150-160 in-lb
Motor Terminals (+ and –)	M6 Nut	25-35 in-lb
Motor to Manifold Cap Screws	M5	30-40 in-lb
Reservoir Screws	#10-24 x 5/16	30-35 in-lb
Solenoid Valves	7/8 Hex Head	19-21 ft-lb
Coil Nuts	3/4 Hex-Head Jam Nut	40-60 in-lb
SAE O-Ring Plugs	1/8 or 5/32 Internal Hex	55-65 in-lb
Hydraulic Unit Mount Bolts	3/8-16 x 1	25-33 ft-lb
Check Valves	7/8 Hex Head	19-21 ft-lb
Motor Relay Small Terminals	#10-32 Nut	15 in-lb max
Motor Relay Large Terminals	5/16-24 Nut	35 in-lb max
Motor Relay Mount Screws	1/4-20 x 1/4	60-70 in-lb
Plow Module Mount Screws	1/4-20 x 5/8	60-70 in-lb
Angle Ram Gland Nuts		150-180 ft-lb

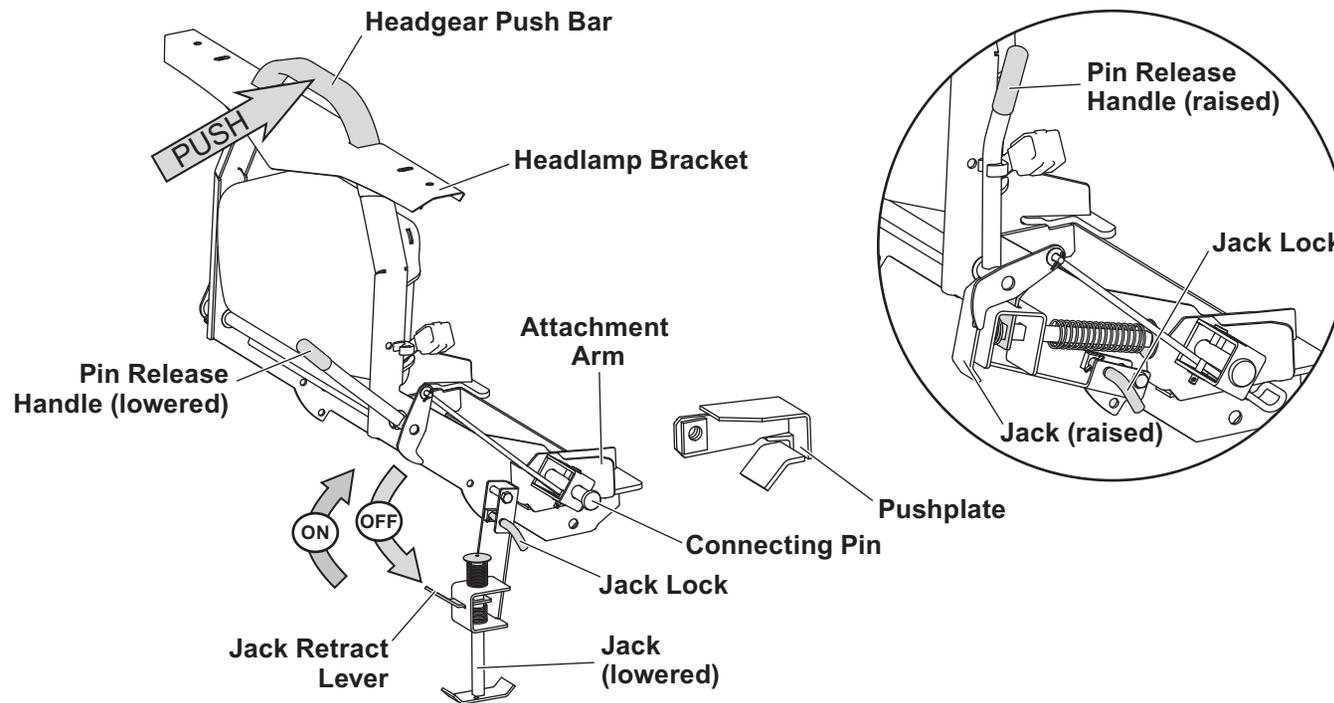
AeroShell® is a registered (®) trademark of Shell Oil Company.

# ATTACHING/DETACHING SNOWPLOW FROM VEHICLE

## HT Series™ ATTACH/DETACH DIAGRAM

**NOTE:** After each use of the snowplow, reapply dielectric grease to the electrical plugs to maintain the protective coating on the terminals.

**NOTE:** Multiplexed 2-plug systems are equipped with plug covers.



# OPERATIONAL TEST AND FINAL ADJUSTMENTS

## FILLING HYDRAULIC UNIT

### ⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered, or angled. Do not stand between the vehicle and blade or directly in front of blade. If the blade hits or drops on you, you could be seriously injured.

1. Attach the snowplow to the vehicle according to the instructions on the back of the blade. The HT Series™ snowplow hydraulic system comes pre-assembled, filled, and fully tested from the factory.

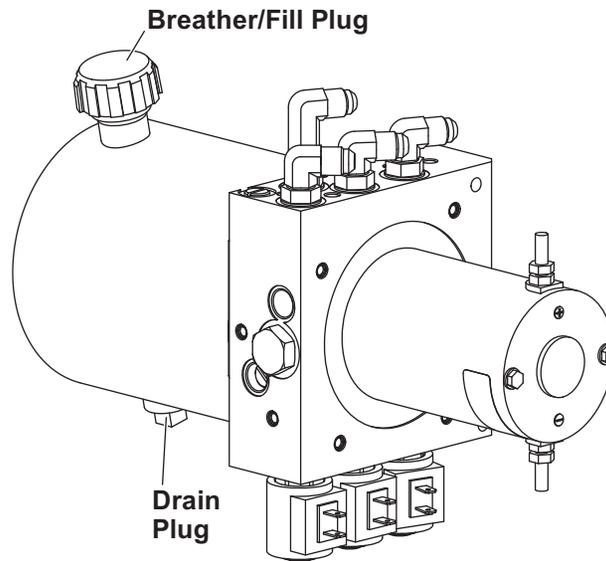
### ⚠ WARNING

To prevent accidental movement of the blade, always turn the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

### ⚠ CAUTION

Do not mix different types of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.

2. Remove factory installed pipe plug. Reservoir fluid level should be within 2-1/2" from the top of the fill hole. If additional fluid is needed, fill the reservoir with FISHER® EZ Flow Hydraulic Fluid to -40°F (-40°C), or other fluid conforming to Military Specification MIL-H-5606A, such as Mobil Aero HFA or Shell AeroShell® Fluid 4.
3. Replace with breather/fill plug (included in parts box).



### FLUID CAPACITY

- Insta-Act® Unit Reservoir 1-3/4 qt
- Insta-Act System Total 2-3/8 to 2-3/4 qt

## BLADE DROP SPEED ADJUSTMENT

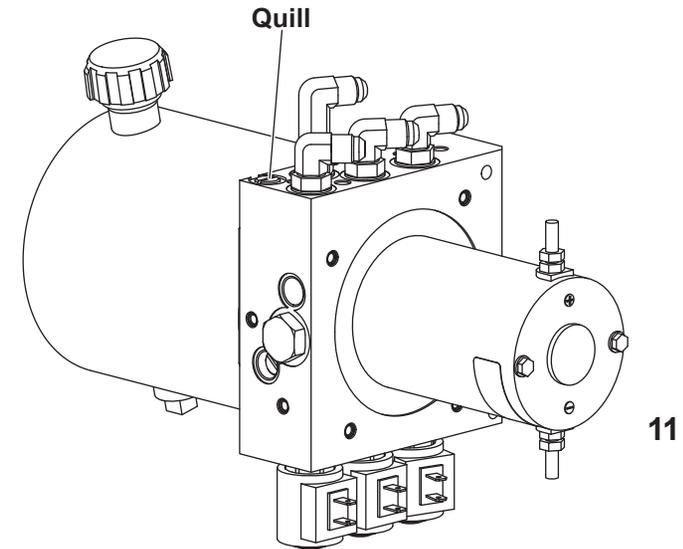
### ⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered, or angled. Do not stand between the vehicle and blade or directly in front of blade. If the blade hits or drops on you, you could be seriously injured.

The quill in the valve manifold adjusts the blade drop speed.

1. Lower the blade to the ground before making adjustment.

2. Turn the quill IN (clockwise) to decrease drop speed. Turn the quill OUT (counterclockwise) to increase drop speed.



3. Stand 8' clear of the blade when checking adjustment.

## FINAL ADJUSTMENTS

1. With the snowplow attached to the properly ballasted vehicle and the blade lowered to the ground, the A-frame should be parallel with the ground.
2. Fully angle the blade in raised and lowered positions. Adjust hose fittings and wraps so that hoses do not contact vehicle bumper, have no sharp bends, and are wrapped at contact points with headgear and blade.

# SYSTEM OVERVIEW

## VEHICLE LIGHTING CHECK

1. Verify the operation of all vehicle front lighting prior to connecting the snowplow harness.
2. Check the operation of the snowplow lights with snowplow mounted to vehicle and all harnesses connected.

### Turn signals and parking lamps

Move vehicle headlamp switch to the parking lamp "ON" position.

Parking lamps ON:

- Both vehicle and snowplow parking lamps should be ON at the same time.

Driver-side turn signal ON:

- Both vehicle and snowplow driver-side turn signal lamps should flash at the same time.

Passenger-side turn signal ON:

- Both vehicle and snowplow passenger-side turn signal lamps should flash at the same time.

### Headlamps

Move vehicle headlamp switch to the "ON" position. Connecting and disconnecting the headlamp harness plug should switch between vehicle and snowplow headlamps as follows:

Headlamp harness plug DISCONNECTED:

- Vehicle headlamps/parking lamps should be ON.
- Snowplow headlamps/parking lamps should be OFF.

Headlamp harness plug CONNECTED:

- Snowplow headlamps/parking lamps should be ON.
- Vehicle headlamps should be OFF.

Dimmer switch should dim whichever headlamps are operating. The high beam indicator on the dash should light when either set of headlamps is on high beam.

### Daytime Running Lamps (DRLs) for PN 29070-1:

With the dedicated DRLs on the truck turned ON, the snowplow turn signals will turn ON.

If DRLs are in high or low beam filament when the snowplow is attached, the corresponding snowplow lamps will turn ON.

### Joystick Control or Fish-Stik® Hand-Held Control

The control indicator light should light whenever the control ON/OFF switch and the ignition (key) switches are both in the "ON" position. The snowplow plugs do need to be connected to the vehicle harness connectors.

3. Check aim of vehicle headlamps with snowplow removed.
4. Connect all snowplow and vehicle harnesses. Raise the snowplow and aim snowplow

### CAUTION

**On 2-plug electrical systems, plug covers shall be used whenever snowplow is disconnected. Vehicle battery cable is 12V unfused source.**

headlamps according to the Snowplow Headlamp Beam Aiming instructions included with the headlamps and any state or local regulations.

5. When the snowplow is removed from the vehicle, install plug covers on the vehicle battery cable and lighting harness. Insert the snowplow battery cable and lighting harness into the cable boot on the snowplow.

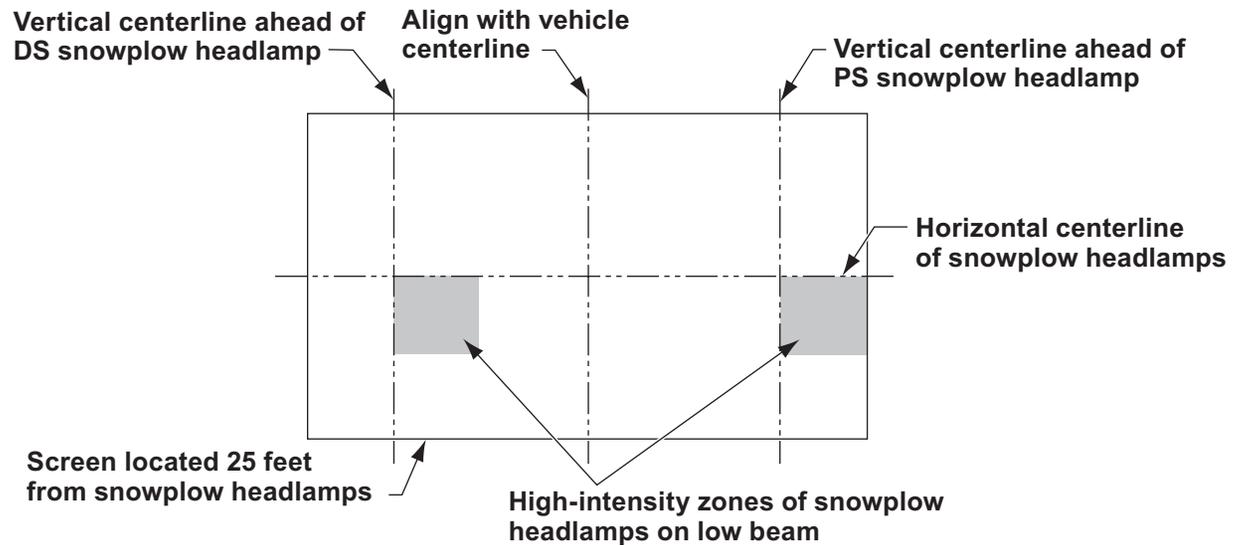
# SYSTEM OVERVIEW

## HEADLAMP BEAM AIMING

Torque headlamp fasteners to 45 ft-lb once correct visual aim is achieved.

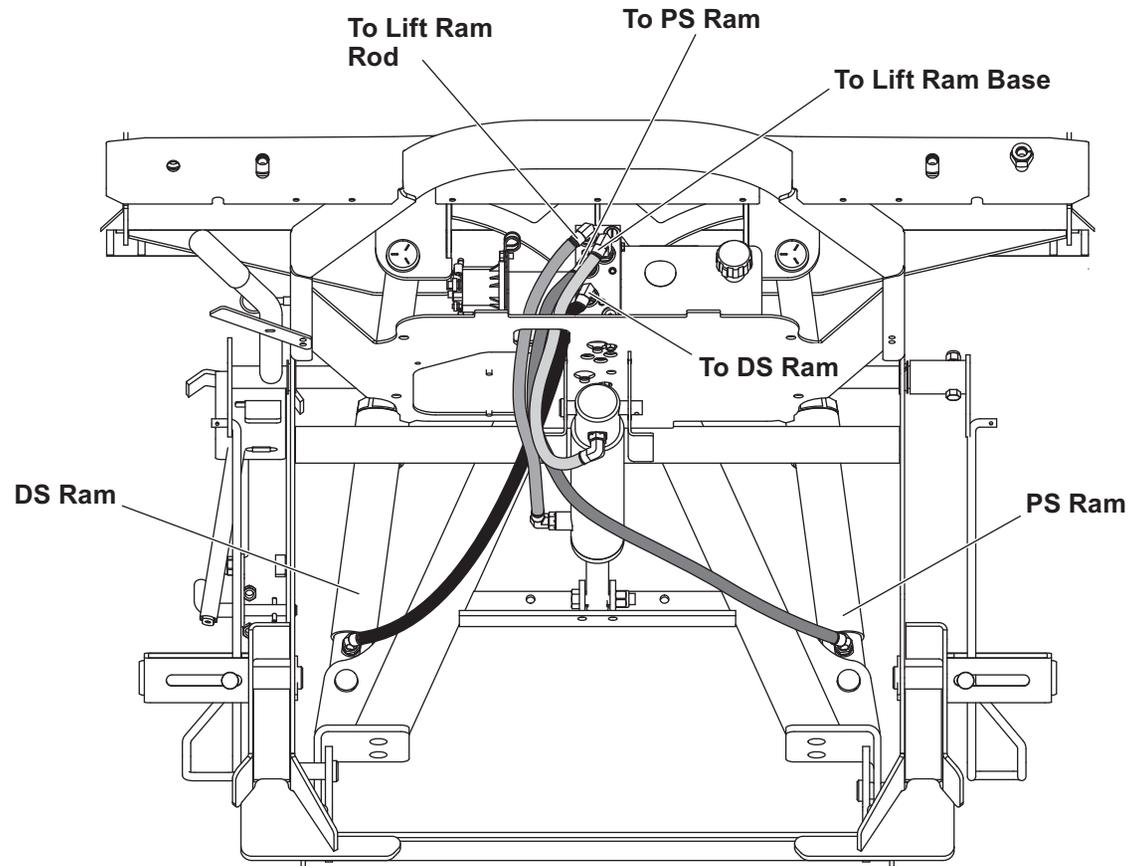
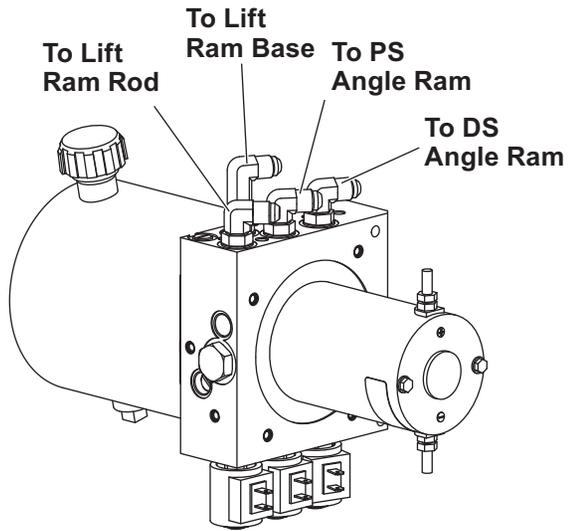
1. Place vehicle on a level surface 25 feet in front of a matte-white screen, such as a garage door. The screen should be perpendicular both to the ground and to the vehicle centerline.
2. The vehicle should be equipped for normal operation. The snowplow blade should be in place and in raised position. Below are steps listed by the Society of Automotive Engineers (SAE) pertinent to headlamp aiming in specification #SAE J599d.
  - e. Check functioning of any automatic vehicle leveling systems and specific manufacturer's instructions pertaining to vehicle preparation for headlamp aiming.
  - f. Clean lenses.
  - g. Check for bulb burnout and proper beam switching.
  - h. Stabilize suspension by rocking vehicle sideways.
3. Prepare vehicle for headlamp aim or inspection. Before checking beam aim, the inspector will:
  - a. Remove ice or mud from under fenders.
  - b. Set tire inflation pressures to the values specified on vehicle information label.
  - c. Check springs for sag or broken leaves.
  - d. See that there is no load in the vehicle other than the driver and ballast as specified in the eMatch selection system.
4. Mark (or tape) the vertical centerline of the snowplow headlamps and the vertical centerline of the vehicle on the screen. Mark the horizontal centerline of the snowplow headlamps on the screen (distance from ground to snowplow headlamp centers).
5. Align the top edge of the high intensity zone of the snowplow lower beam below the horizontal centerline and the left edge of the high intensity zone on the vertical centerline for each snowplow headlamp. (Refer to diagram.)

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# SYSTEM OVERVIEW – HYDRAULIC HOSE ROUTING

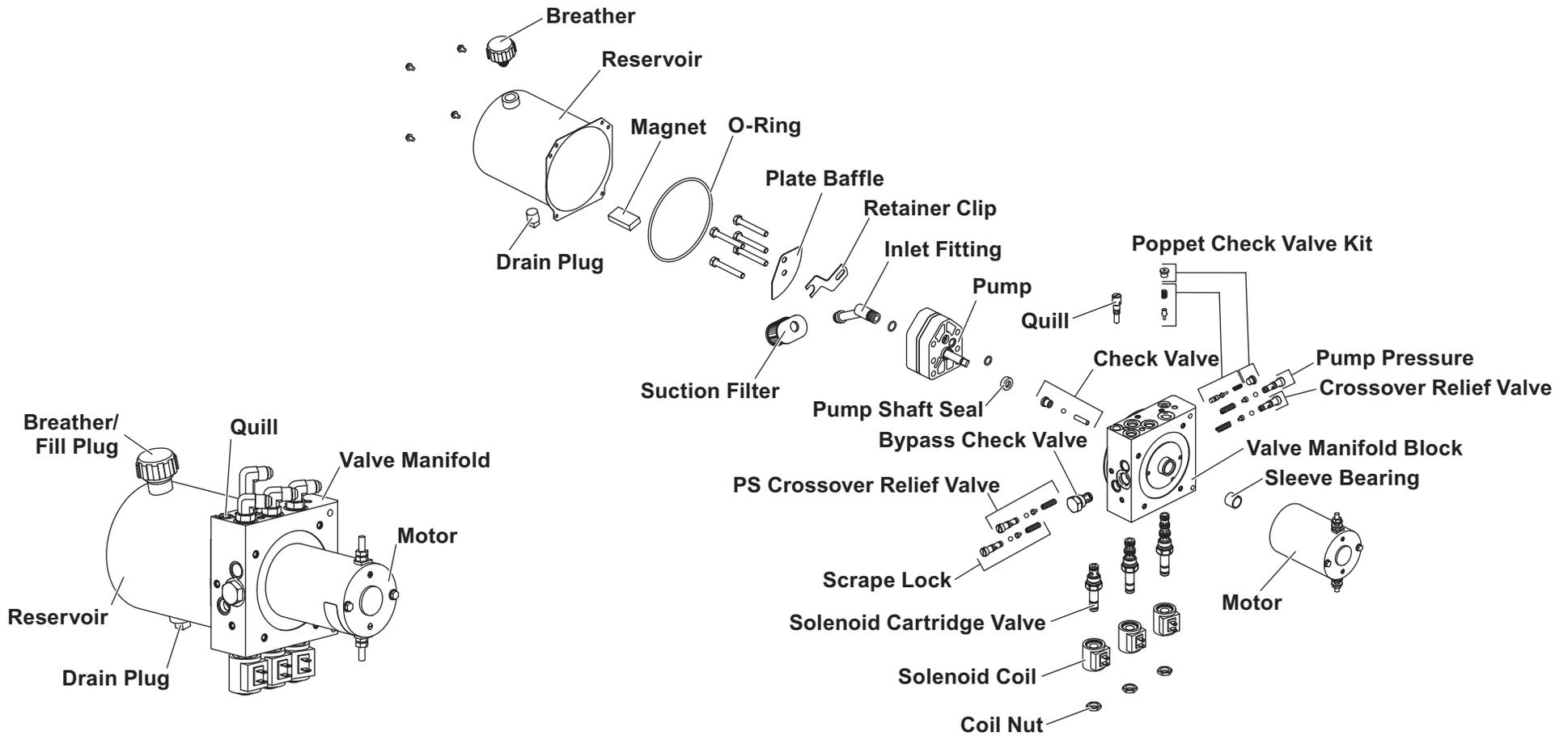
## HOSE ROUTING FOR HT Series™ BLADES



# SYSTEM OVERVIEW – HYDRAULIC UNIT

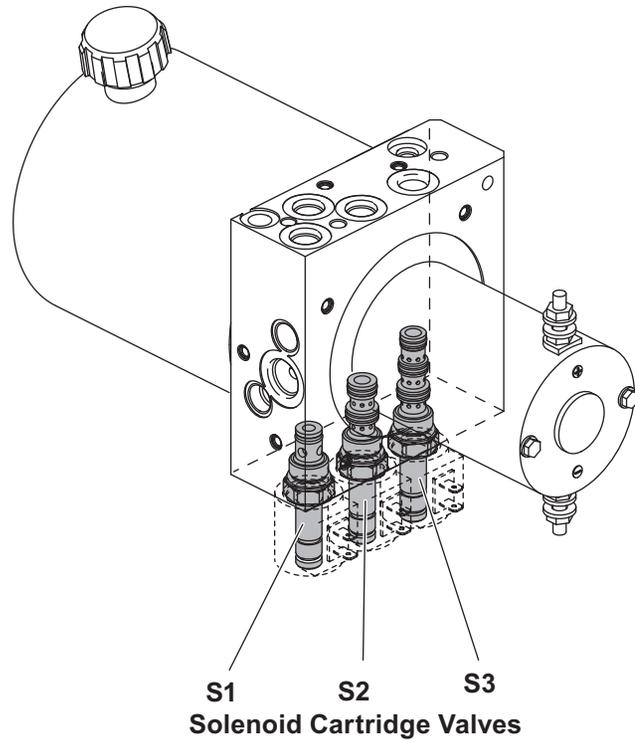
## Insta-Act® HYDRAULIC UNIT

The HT Series™ hydraulic unit has blade scrape lock circuitry built in. This feature is activated when the blade is in FLOAT. The HT Series blade is raised in approximately 4 seconds and angled side to side in approximately 3 seconds.

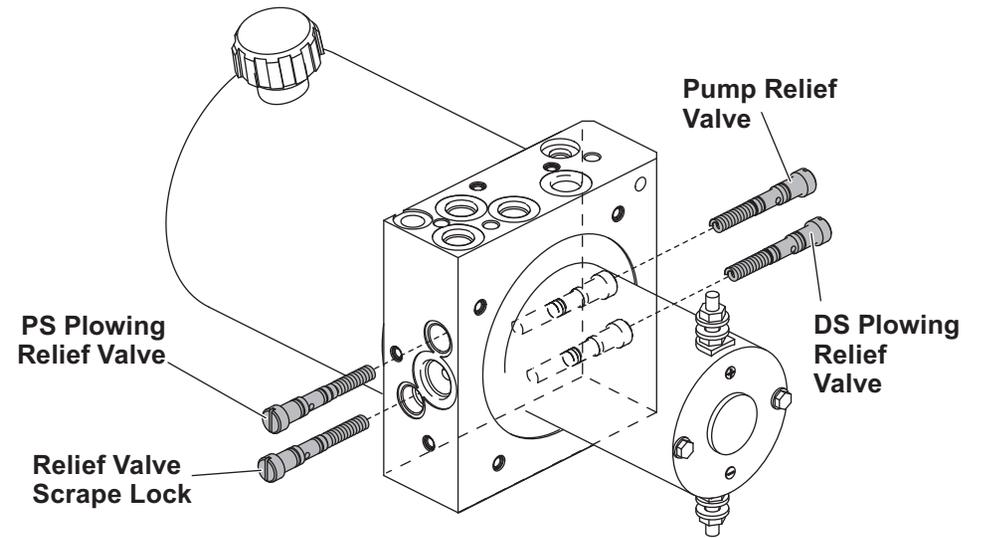


# SYSTEM OVERVIEW – HYDRAULIC UNIT

## SOLENOID CARTRIDGE VALVE IDENTIFICATION & LOCATION



## RELIEF VALVE IDENTIFICATION & LOCATION

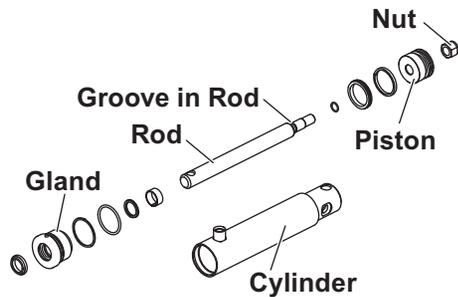


# SYSTEM OVERVIEW – HYDRAULIC

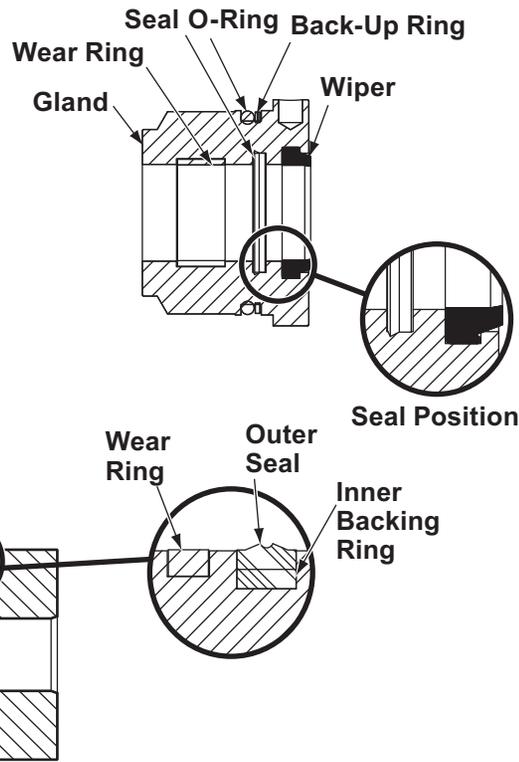
## HYDRAULIC COMPONENT INSTALLATION

### Ram Seal Installation

1. Lubricate O-rings before assembly.
2. Assemble gland components as shown, then lubricate.
3. Remove piston from rod and assemble piston components as shown.



4. Assemble gland to threaded end of rod. Do not slide gland over cross hole in rod.
5. Reassemble piston to rod and tighten nut to 100–120 ft-lb.
6. Assemble O-ring into groove on rod. Use tape or other protection on threads.
7. Apply bead of medium-strength threadlocker all around threads of gland.
8. Lubricate piston seals and inside of cylinder.
9. Press rod assembly into cylinder and tighten gland to 30–40 ft-lb.



### Cartridge & Check Valve Removal

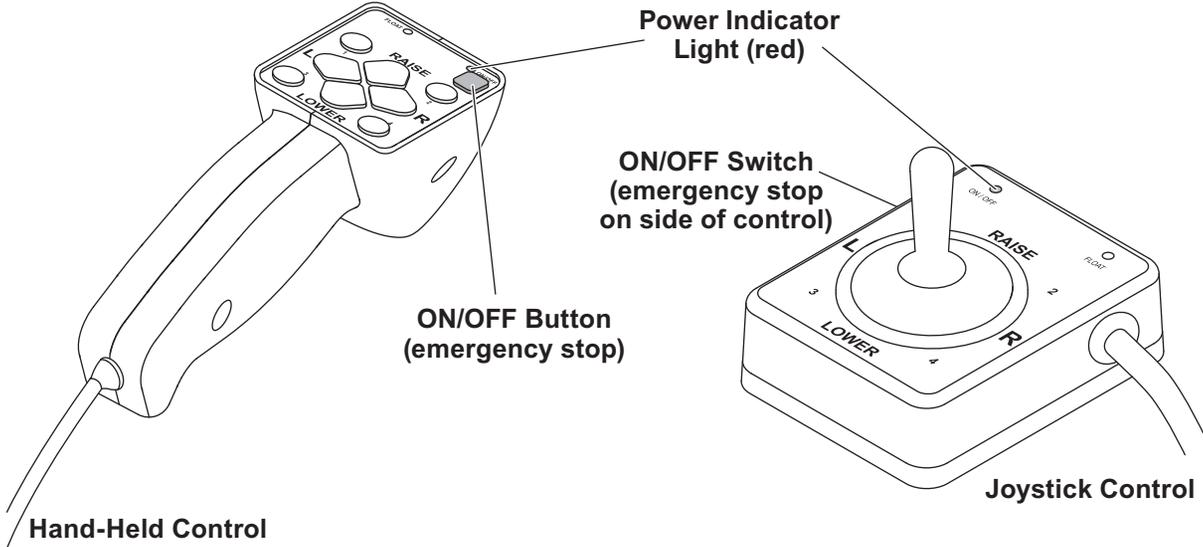
It is possible to remove cartridges and check valves from a hydraulic unit without draining the hydraulic fluid from the reservoir.

1. Install the Diagnostic Harness (PN 29290-2) following the instructions included with the kit.

2. Cycle through the control functions twice to remove the pressure in the hydraulic unit.
3. Slowly remove the breather from the top of the hydraulic unit.
4. Either (a) completely drain reservoir and skip to Step 9 or (b) proceed with instructions for removing hydraulic components without completely draining reservoir.
5. Install a 3/8" barb fitting into the top of the reservoir tank.
6. Attach a hand-operated vacuum pump to the barb fitting.
7. Using the vacuum pump, pull a vacuum of approximately 5"–10" Hg.
8. You should now be able to remove cartridges and check valves from the hydraulic unit with minimal fluid loss. Maintain the vacuum until the replacement cartridge/check valve has been installed. Once the replacement part has been installed, release the vacuum and remove the 3/8" barb fitting.
9. Reinstall the breather and remove the 29290-2 Diagnostic Harness according to the instructions included with the kit.

Excerpts taken from UltraMount® 2 Owner's Manual (Lit. No. 43181, Rev. 01).

# SYSTEM OVERVIEW – HT Series™ CONTROLS



# HAND-HELD CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

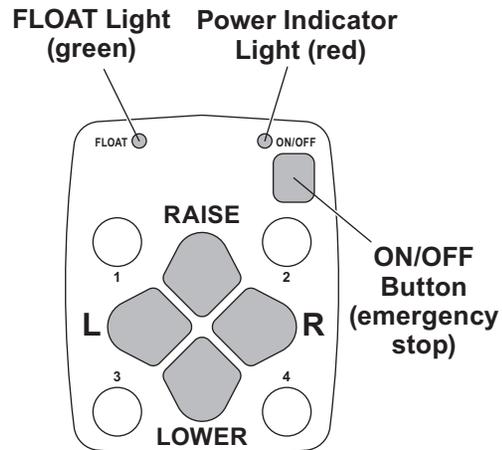
## CONTROL OVERVIEW

### **⚠ WARNING**

To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

The SECURITY GUARD feature was developed as an electrical anti-theft system for the half-ton snowplows. The system provides a deterrent from theft and/or non-permitted use by allowing you to electronically lock the snowplow's hydraulic functions.

All half-ton snowplow controls come equipped with the SECURITY GUARD system. To use this function, you must complete the steps under the "Activation & Establishing a 4-Digit Security Code" section later in this guide.



Each control is equipped with an ON/OFF switch and an indicator light to show when the control is powered ON or OFF. The controls are powered by the vehicle's battery, so your vehicle ignition (key) switch must be ON to use the controls.

### **Before Activating the SECURITY GUARD System:**

Install the control as stated in the Hand-Held Control Kit Installation Instructions, and check all snowplow functions as described below.

### **OPERATING THE HAND-HELD CONTROL**

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
2. Press the ON/OFF button on the control. The power indicator light glows red, indicating the control is ON. The power indicator light glows red whenever the control and the vehicle ignition switch are both ON and the electrical connections to the snowplow are completed.

The ON/OFF button operates as an emergency stop if required.

### **Function Time-Outs**

All control functions, except LOWER/FLOAT, time out (stop) automatically after a period of time. This is to limit the amount of electrical energy required from the vehicle.

**NOTE: If control function times out before desired blade movement is complete, release button and press again.**

### **Automatic Shutdown**

The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shutdown, press the ON/OFF button.

# HAND-HELD CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

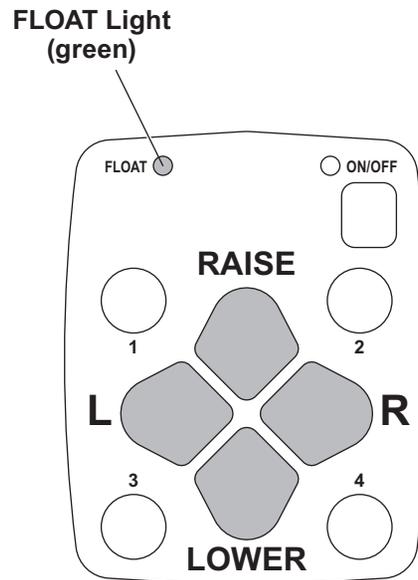
## Smooth Stop

The control automatically allows the blade to coast to a stop when the button is released. This results in smoother operation, reduces the shock to the hydraulic system, and increases hose and valve life.

## Control Functions

### Raise, Lower, Float, Angle

The four diamond-shaped buttons in the center of the control face, when pressed, will result in the blade movements described in the table.



Function	Description of Operation
<b>RAISE</b>	Press this button to raise the snowplow and cancel the FLOAT mode. Function times out after 4.8 seconds.
<b>LOWER</b>	Press this button to lower the snowplow. Release the button to stop blade at desired height.
<b>FLOAT</b>	Press the <b>LOWER</b> button and hold 3/4 second to activate this mode. The FLOAT light in the upper left corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or raises. Function does not time out, but control will shut down after 20 minutes of nonuse. Press <b>RAISE</b> button momentarily to cancel FLOAT. Angling left or right will not interrupt (stop) the FLOAT function.
<b>L</b> (Angle Left)	Press this button to angle the blade to the left. Function times out after 9.6 seconds.
<b>R</b> (Angle Right)	Press this button to angle the blade to the right. Function times out after 9.6 seconds.
<b>1 &amp; 4</b>	Used to access the SECURITY GUARD system activation mode.
<b>2 &amp; 3</b>	Used to clear the entered SECURITY GUARD system code.

20

**NOTE: If control function times out before desired blade movement is complete, release button and press again.**

# HAND-HELD CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

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## SECURITY GUARD System

### Activation & Establishing a 4-Digit Security Code

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**NOTE: The snowplow must be attached to the vehicle, and all the electrical connections must be connected prior to activating the security code function.**

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1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position. (It is not necessary to start the vehicle.)
2. Verify that the control power indicator is OFF. If the power indicator light is red, the control is ON. Press the ON/OFF button to turn the hand-held control OFF.
3. To activate the SECURITY GUARD mode, press the control #1 button four consecutive times, and then press the #4 button four consecutive times (sequence: 1, 1, 1, 1, 4, 4, 4, 4). The green FLOAT light will flash quickly and the red POWER light will turn ON indicating the system is ready to accept your 4-digit security code. Enter your 4-digit security code by pressing any of the eight following buttons in any sequence: UP, DOWN, LEFT, RIGHT, 1, 2, 3, or 4.

Once you have entered your 4-digit security code, the FLOAT light will stop flashing and the POWER light will turn OFF. This indicates that your 4-digit security code is entered and stored in the SECURITY GUARD system.

4. Once a 4-digit security code is established, the SECURITY GUARD system will recognize any control that has been programmed with the same 4-digit security code. If a control not programmed with the correct 4-digit security code is connected to the system, the established security code will have to be entered manually before the snowplow can be activated (see the Manual Unlock procedure).

**NOTE: If the control POWER button is turned ON prior to completing the programming procedure, your 4-digit security code will be cancelled.**

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### Manual Unlock

If the SECURITY GUARD system is activated and you are using a HT Series™ control with a different 4-digit code than the established security code, you will be required to manually enter the 4-digit security code before operating a locked snowplow.

1. Turn the vehicle ignition to the "ON" or "ACCESSORY" position.
2. Turn the control ON.
3. The POWER light will flash rapidly, indicating that the snowplow is locked.
4. Enter the 4-digit security code.
5. After entering the correct security code, the POWER light will change from flashing rapidly to a solid light to indicate the snowplow has been successfully unlocked.

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**NOTE: If the plow/vehicle electrical connection is lost or disconnected, the SECURITY GUARD system will reset, requiring any HT Series control that is not programmed with the established 4-digit security code to manually re-enter the security code to activate the snowplow.**

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### Clearing an Established 4-Digit Security Code

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
2. If the snowplow is locked (the control POWER light will be flashing at a fast rate), unlock the snowplow by following the Manual Unlock procedure.
3. Turn the control OFF. Verify that the power indicator is OFF.
4. With the control OFF, press the #2 button four consecutive times, and then press the #3 button four consecutive times. This sequence (2, 2, 2, 2, 3, 3, 3, 3) will clear the 4-digit security code from the SECURITY GUARD system. The FLOAT light will flash to indicate that the 4-digit security code was cleared.

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**NOTE: To enter a new 4-digit security code see Activation & Establishing a 4-Digit Security Code.**

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# HAND-HELD CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

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## Light Flash Indicators

POWER – Red	Function
Off	Control is OFF
Solid On	Control is ON and active
Slow Flash	No communication
Fast Flash	Snowplow is locked – enter 4-digit security code to unlock

FLOAT – Green	Function
Solid On	Float function is active
Fast Flash	Security code activation in progress

## Additional Notes

- The SECURITY GUARD system requires any HT Series™ control (other than the one with the assigned 4-digit security code) to enter the security code before the snowplow can be activated. Once the security code is established, the SECURITY GUARD system recognizes that a control with the same security code is attached, and does not require a manual unlock to activate the snowplow. The system will recognize the control as "safe" and will automatically unlock.
- The SECURITY GUARD system is only fully functional with hand-held controls PN 49800.
- In the event that a snowplow is locked and cannot be manually unlocked or reset, contact your Authorized Dealer.
- REMINDER: Record your security code for future reference.

# JOYSTICK CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

## CONTROL OVERVIEW

### ⚠ WARNING

To prevent accidental movement of the blade, always move the ON/OFF switch to OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

The SECURITY GUARD feature was developed as an electrical anti-theft system for the half-ton snowplows. The system provides a deterrent from theft and/or non-permitted use by allowing you to electronically lock the snowplow's hydraulic functions.

All half-ton snowplow controls come equipped with the SECURITY GUARD system. To use this function, you must complete the "Activation" process.

Each control is equipped with an ON/OFF switch and an indicator light to show when the control is powered ON or OFF. The controls are powered by the vehicle's battery, so your vehicle ignition (key) switch must be ON to use the controls.

### Before Activating the SECURITY GUARD System:

Install the control as stated in the Joystick Control Kit Installation Instructions, and check all snowplow functions as described below.

### OPERATING THE JOYSTICK CONTROL

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
2. Move the slide switch on the side of the control to the "ON" position. The power indicator light glows red, indicating the control is ON. The indicator light glows red whenever the control and the vehicle ignition switch are both ON and the electrical connections to the snowplow are completed.

The ON/OFF switch operates as an emergency stop if required.

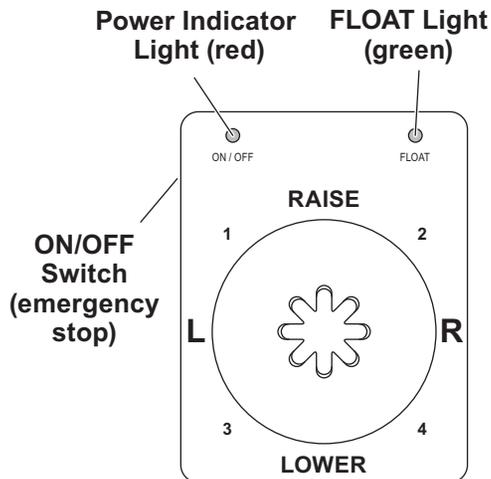
### Function Time-Outs

All control functions, except LOWER/FLOAT, time out (stop) automatically after a period of time. This is to limit the amount of electrical energy required from the vehicle.

**NOTE: If control function times out before desired blade movement is complete, release the lever to the center position, then move back into the desired function.**

### Automatic Shutdown

The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shutdown, move the ON/OFF switch to OFF, then back to ON.



# JOYSTICK CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

## Smooth Stop

The control automatically allows the blade to coast to a stop when the lever returns to center position. This results in smoother operation, reduces the shock to the hydraulic system, and increases hose and valve life.

## Control Lever Movement

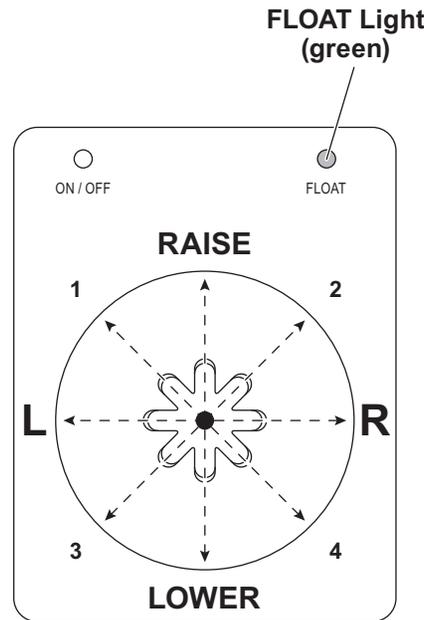
From the center position, the control lever can be moved in one of eight (8) directions to control various movements of the snowplow blade. To change from one movement of the blade to another, the control lever must be moved back to the center position before selecting the desired function. Whenever the lever is released, it should spring back into the center position to stop any blade movement.

## Control Functions

### Raise, Lower, Float, Angle

Moving the control lever in straight lines up and down or from side to side on the control body will result in the blade movements described in the following tables.

**NOTE: If control function times out before desired blade movement is complete, release the lever to the center position, then move back into the desired function.**



Function	Description of Operation
<b>RAISE</b>	Move the control lever toward the top of the control body to raise the snowplow and cancel the FLOAT mode. Function times out after 4.8 seconds.
<b>LOWER</b>	Move the control lever toward the bottom of the control body to lower the snowplow. Release the lever to stop blade at the desired height.
<b>FLOAT</b>	Move the control lever to the <b>LOWER</b> position and hold 3/4 second to activate this mode. The FLOAT light in the upper right corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or raises. Function does not time out; however, control will shut down after 20 minutes of nonuse.  Move lever to the <b>RAISE</b> position momentarily to cancel FLOAT. Angling left or right will not interrupt (stop) the FLOAT function.
<b>L</b> (Angle Left)	Move the control lever straight to the left to angle the blade left. Function times out after 9.6 seconds.
<b>R</b> (Angle Right)	Move the control lever straight to the right to angle the blade right. Function times out after 9.6 seconds.
<b>1 &amp; 4</b>	Used to access the SECURITY GUARD system activation mode.
<b>2 &amp; 3</b>	Used to clear the entered SECURITY GUARD system code.

# JOYSTICK CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

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## SECURITY GUARD System

### Activation & Establishing a 4-Digit Security Code

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**NOTE: The snowplow must be attached to the vehicle and all the electrical connections must be connected prior to activating the security code function.**

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1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position. (It is not necessary to start the vehicle.)
2. Verify the control power indicator is OFF. If the power indicator light is red, the control is ON. Slide the ON/OFF switch to "OFF" to turn the control OFF.
3. To activate the SECURITY GUARD mode, move the control lever into the #1 position four consecutive times, and then in the direction of the #4 position four consecutive times (sequence: 1, 1, 1, 1, 4, 4, 4, 4). The green FLOAT light will flash quickly and the red POWER light will turn ON indicating the system is ready to accept your 4-digit security code.

Enter your 4-digit security code by moving the control lever into the position of any of the eight following positions: UP, DOWN, LEFT, RIGHT, 1, 2, 3, or 4.

Once you have entered your 4-digit security code, the FLOAT light will stop flashing and the POWER light will turn OFF. This indicates that your 4-digit security code is entered and stored in the SECURITY GUARD system.

4. Once a 4-digit security code is established, the SECURITY GUARD system will recognize any control that has been programmed with the same 4-digit security code. If a control not programmed with the correct 4-digit security code is connected to the system, the established security code will have to be entered manually before the snowplow can be activated (see the Manual Unlock procedure).

**NOTE: If the control POWER switch is turned ON prior to completing the programming procedure, your 4-digit security code will be cancelled.**

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### Manual Unlock

If the SECURITY GUARD system is activated and you are using a HT Series™ control with a different 4-digit code than the established security code, you will be required to manually enter the 4-digit security code before operating a locked snowplow.

1. Turn the vehicle ignition to the "ON" or "ACCESSORY" position.
2. Slide the control switch to the "ON" position.
3. The POWER light will flash rapidly, indicating that the snowplow is locked.
4. Enter the 4-digit security code.
5. After entering the correct security code, the POWER light will change from flashing rapidly to a solid light to indicate the snowplow has been successfully unlocked.

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**NOTE: If the plow/vehicle electrical connection is lost or disconnected, the SECURITY GUARD system will reset, requiring any HT Series control that is not programmed with the established 4-digit security code to manually re-enter the security code to activate the snowplow.**

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### Clearing an Established 4-Digit Security Code

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
2. If the snowplow is locked (the control POWER light will be flashing at a fast rate), unlock the snowplow by following the Manual Unlock procedure.
3. Slide the control switch to the "OFF" position. Verify that the power indicator is OFF.
4. With the control OFF, move the control lever to the #2 position four consecutive times, and then to the #3 position four consecutive times. This sequence (2, 2, 2, 2, 3, 3, 3, 3) will clear the 4-digit security code from the SECURITY GUARD system. The FLOAT light will flash to indicate that the 4-digit security code was cleared.

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**NOTE: To enter a new 4-digit security code see Activation & Establishing a 4-Digit Security Code.**

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# JOYSTICK CONTROL WITH SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

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## Light Flash Indicators

POWER – Red	Function
Off	Control is OFF
Solid On	Control is ON and active
Slow Flash	No communication
Fast Flash	Snowplow is locked – enter 4-digit security code to unlock

FLOAT – Green	Function
Solid On	Float function is active
Fast Flash	Security code activation in progress

## Additional Notes

- The SECURITY GUARD system requires any HT Series™ control (other than the one with the assigned 4-digit security code) to enter the security code before the snowplow can be activated. Once the security code is established, the SECURITY GUARD system recognizes that a control with the same security code is attached, and does not require a manual unlock to activate the snowplow. The system will recognize the control as "safe" and will automatically unlock.
- The SECURITY GUARD system is only fully functional with joystick controls PN 49700.
- In the event that a snowplow is locked and cannot be manually unlocked or reset, contact your Authorized Dealer.
- REMINDER: Record your security code for future reference.

# HAND-HELD MASTER CONTROL FOR THE SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

## UNIVERSAL CLEAR SECURITY

### ⚠ WARNING

To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

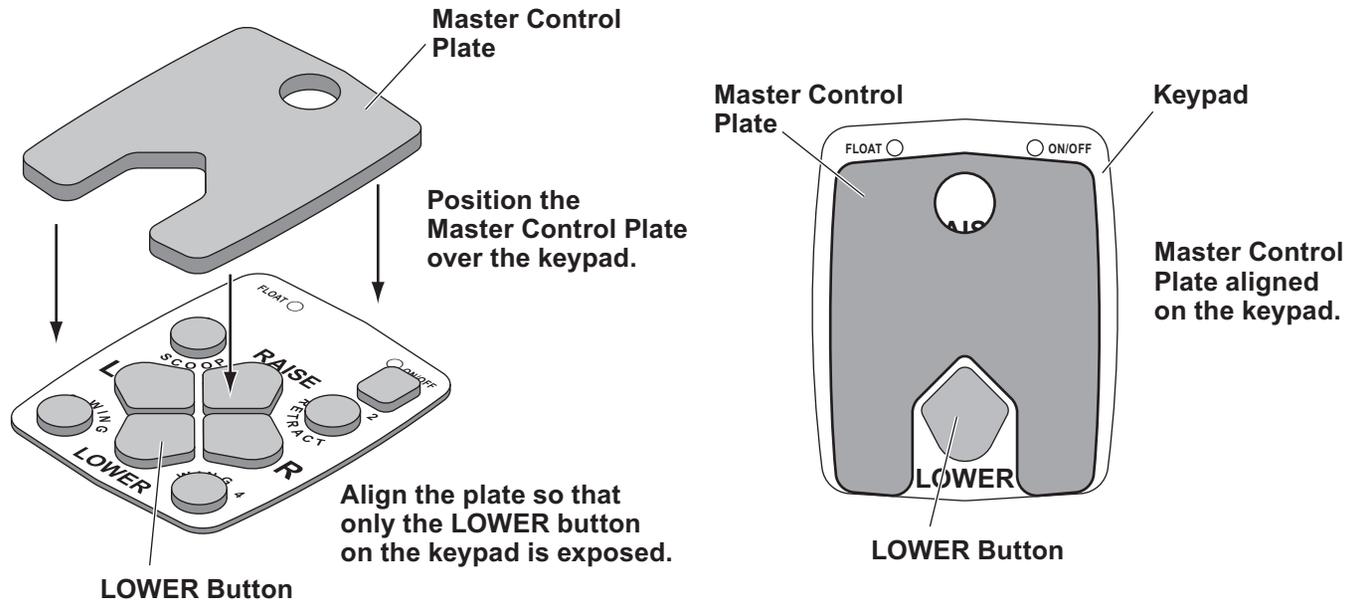
Perform the following steps to unlock and clear an established security code, without using the original control that was used to establish the code. This procedure should be used to reset the module if the security code is unknown.

**IMPORTANT:** The following steps must be performed using the Distributor Master Control (PN 48800). Only the Distributor Master Control can clear an established code within a snowplow module without using the original control used to establish the code.

1. Turn the vehicle ignition to the "OFF" position.
2. With the control power OFF, using the tool that was included in the Distributor Master Control box, place the tool over the keypad and push down on the plate.

**NOTE:** The only button that should be exposed is the LOWER button. All other buttons should be engaged and pressed down.

3. While pushing down on the tool engaging all functions except LOWER, turn the ignition ON.
4. Upon turning the ignition to the "ON" position, the module has been reset, and there is no security code associated with the snowplow.



# THEORY OF OPERATION

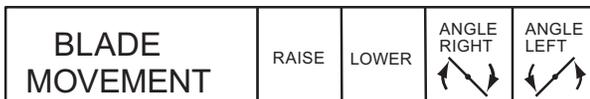
## SNOWPLOW HYDRAULICS

The HT Series™ snowplow hydraulic system performs four blade movements.

All functions require the vehicle ignition (key) switch to be in the "ON" or "ACCESSORY" position and the power to be activated on the snowplow cab control.

Three of the four hydraulic movements require energizing the electric motor and appropriate solenoid cartridge valves. The fourth function, LOWER, does not energize the motor but requires activating a cartridge valve.

Power from the vehicle battery is supplied to the solenoid coils and the snowplow control via the Isolation Module. The solenoid cartridge valves operate in various combinations, directed by the cab control, to send hydraulic fluid to the snowplow lift and angle rams and/or back to the reservoir. (Power is supplied to the Plow Module via the battery cable and motor relay connection.)



## Snowplow Daytime Running Lights

Because Daytime Running Lamps (DRLs) are controlled differently on some vehicles, two Isolation Modules have been developed.

The standard Isolation Module transfers the DRL output from the vehicle headlamps to the snowplow lights when the vehicle ignition switch is turned ON and the snowplow is attached.

The second Isolation Module, designed for vehicles with dedicated DRL bulbs, senses the vehicle in the DRL mode and a series of relays energize, placing the snowplow low beams in series. This Isolation Module does not turn off the vehicle's dedicated DRLs.

## 3-PORT MODULE ELECTRICAL

### Overview

The Isolation Module acts as an electrical hub, automatically directing vehicle power to the appropriate vehicle or snowplow lighting devices, while also supplying battery power to the snowplow control.

The vehicle high and low beams enter and exit the Isolation Module through port B (left side lighting) and port C (right side lighting). Park, turn, and DRL signals also enter through ports B and C.

The output of the vehicle high beam/low beam select switch is directed to the Isolation Module via the plug-in harness. When the snowplow is not attached to the vehicle, the signal passes through the normally closed relay contacts to the vehicle headlamps. During this time, the Isolation Module is inactive, placing no current draw on the vehicle's electrical system.

With the snowplow attached, the Isolation Module is still inactive until either of the two following conditions are met: the vehicle parking lights are turned ON or the vehicle ignition switch is turned ON.

Turning ON the vehicle parking lights activates a series of relays, automatically transferring the vehicle high and low beams to the snowplow while supplying battery power directly to the snowplow parking lights. All snowplow lighting exits the Isolation Module through port A.

Turning ON the vehicle ignition switch energizes a snowplow control relay, supplying vehicle battery power directly to the control via the vehicle control harness and plug-in harness. The vehicle ignition switch also supplies power to the vehicle turn signals. Activating the vehicle turn signals energizes the turn signal circuit, which supplies vehicle battery power directly to the snowplow turn signals.

# THEORY OF OPERATION

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## 3-PORT MODULE ELECTRICAL

### White Label Non-DRL Module (PN 29060)

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**NOTE: Module has been replaced by  
PN 29070-1.**

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#### **Snowplow not attached to vehicle:**

System is inactive. Vehicle lighting system functions normally.

Reason: No ground to module.

#### **Snowplow attached to vehicle:**

System is inactive until either the switched accessory wire or the vehicle parking lights are activated. Vehicle and snowplow lighting systems function as outlined in the Theory of Operation overview.

Reason: Ground path is established from battery common to pin C on port A of the 3-port module via the following harnesses: vehicle battery cable, vehicle control harness, plug-in harness, vehicle lighting harness, and snowplow lighting harness.

- Activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the VACC input of the module, which energizes the coil of the control power relay (part of the 3-port module). Energizing the coil of the control power relay causes the relay contacts to shift from the "N.O." (normally opened) position to the "N.C." (normally closed) position, which supplies battery voltage to the snowplow control via the plug-in harness and the vehicle control harness. The switched accessory wire only controls battery voltage to the snowplow control.
- Activating the vehicle **park light** circuit applies battery voltage to the module park circuit input. The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow park lamp filaments via the vehicle and snowplow lighting harnesses. Voltage is also applied to the module's high and low beam relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position.
- With the four headlamp relays shifted to the "snowplow" position, the **vehicle high and low beams** are now directed to the snowplow headlamps via the vehicle and snowplow lighting harnesses. Toggling the dimmer switch between high and low beam will toggle the snowplow high and low beams.
- Activating the **turn signal** applies battery voltage to the module turn signal circuit input. The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow turn signal lamp filaments via the vehicle and snowplow lighting harnesses.
- On vehicles equipped with **DRLs**—either integrated into the vehicle headlamps or separated into dedicated DRL lamps—this module *will not* turn OFF the vehicle DRLs or transfer them to the snowplow. DRLs will remain on the vehicle and operate as the vehicle manufacturer intended.

# THEORY OF OPERATION

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## 3-PORT MODULE ELECTRICAL

### Green Label DRL Module (PN 29070-1)

#### Snowplow not attached to vehicle:

System is inactive. Vehicle lighting system functions normally.

Reason: No ground to module.

#### Snowplow attached to vehicle:

System is inactive until either the switched accessory wire or the vehicle parking lights are activated. Vehicle and snowplow lighting systems function as outlined in the Theory of Operation Overview.

Reason: Ground path is established from battery common to pin C on port A of the 3-port module via the following harnesses: vehicle battery cable, vehicle control harness, adapter, plug-in harness, vehicle lighting harness, and snowplow lighting harness.

- Activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the VACC input of the module. A control circuit senses the voltage and energizes the coil of the control power relay (part of the 3-port module). Energizing the coil of the control power relay causes the relay contacts to shift from the "N.O." (normally opened) position to the "N.C." (normally closed) position, which supplies battery voltage to the snowplow control via the plug-in harness and the vehicle control harness. The switched accessory wire only controls battery voltage to the snowplow control.
- Activating the vehicle **park light** circuit applies voltage to the module park circuit input. A control circuit senses the voltage and turns ON a solid state power device, which applies battery voltage to the snowplow park lamp filaments via the vehicle and snowplow lighting harnesses.
- With the park light circuit energized, the control circuit monitors the **vehicle high and low beam** inputs. When battery voltage is sensed, the appropriate solid state power devices are turned ON, supplying battery voltage to the snowplow headlamps via the vehicle and snowplow lighting harnesses. Toggling the dimmer switch between high and low beam will toggle the snowplow high and low beams.
- Activating the **turn signal** applies voltage to the module turn signal circuit input. A control circuit senses the voltage and turns ON a solid state power device, which applies battery voltage to the snowplow turn signal lamp filaments via the vehicle and snowplow lighting harnesses.
- **PN 29070-1 only:** On vehicles equipped with **DRLs integrated into the vehicle headlamps**. Activation of the switched accessory wire (a key-controlled power source) port C, position C, applies battery voltage to the module's high and low beam relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position. **This module will transfer the vehicle headlamp DRLs to the snowplow (turns off vehicle DRLs).**
- **On vehicles equipped with dedicated DRL bulbs or vehicles using the turn signals as DRLs, this module will not turn OFF the vehicle bulbs. While the vehicle is in the DRL mode, this module will illuminate the snowplow light turn signal filaments.**

# THEORY OF OPERATION

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## 3-PORT MODULE ELECTRICAL

### Blue Label Module (PN 29760-2)

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**NOTE: Limited vehicle application.**

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**According to the vehicle manufacturer, all 2008 Ford Super Duty F-250/350/450/550 trucks built before 04/18/2007 will require this module. Trucks built after that date and having the Plow Prep Package use the green label module (PN 29070-1).**

#### **Snowplow not attached to vehicle:**

System is inactive. Vehicle lighting system functions normally.

#### **Snowplow attached to vehicle and the electrical connections at the grille are made:**

System is inactive until either the vehicle ignition switch or the vehicle parking lights are activated. Vehicle and snowplow lighting systems function as outlined in the Theory of Operation overview.

- Turning on the vehicle ignition switch provides 12V to the switched accessory wire, which in turn applies battery voltage to the VACC input to the module at port C, pin C. A control circuit senses the voltage and energizes the coil of the module control power relay. Energizing the coil of the control power relay causes the relay contacts to shift from the "N.C." (normally closed) position to the "N.O." (normally opened) position, which supplies battery voltage to the snowplow control via the plug-in harness and the vehicle control harness. The switched accessory wire only controls battery voltage to the snowplow control.
- Activating the vehicle **park light** circuit applies battery voltage to the module park circuit input, port B, pin H. The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow park lamp filaments via the vehicle and snowplow lighting harnesses. Voltage is also applied to the module's high and low beam relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position.
- With the headlamp relays shifted to the "snowplow" position, the **vehicle high and low beams** are now directed to the snowplow headlamps via the vehicle and snowplow lighting harnesses. Toggling the dimmer switch between high and low beam will toggle the snowplow high and low beams.
- Activating the **turn signal** applies battery voltage to the module turn signal circuit input.  
  
Left: port B, position G;  
  
Right: port C, position G.  
  
The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow turn signal lamp filaments via the vehicle and snowplow lighting harnesses.
- On vehicles equipped with **DRLs** integrated into the vehicle headlamps, activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the module's **high and low beam** relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position. This module **will** transfer the vehicle headlamp DRLs to the snowplow.

# ELECTRICAL & HYDRAULIC SCHEMATICS

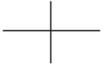
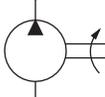
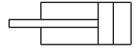
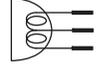
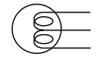
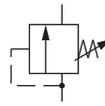
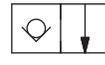
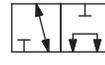
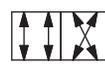
This section contains hydraulic and electrical schematics to help explain how the hydraulic unit performs the different functions. A schematic is an abstract drawing showing the purpose of each component in the system. Each component is represented by a graphical symbol. The hydraulic and electrical legends describe each symbol used in the schematics for this guide.

The first two schematics show an overview of the complete electrical and hydraulic systems. Other schematics highlight the flow of hydraulic oil and electrical current for each function the hydraulic unit performs as well as the flow of electrical current for the snowplow and vehicle lights.

- Bold lines and gray lines (ground) represent the circuit being activated only.
- Shaded components are either activated or shifted from their normal position.

**NOTE:**

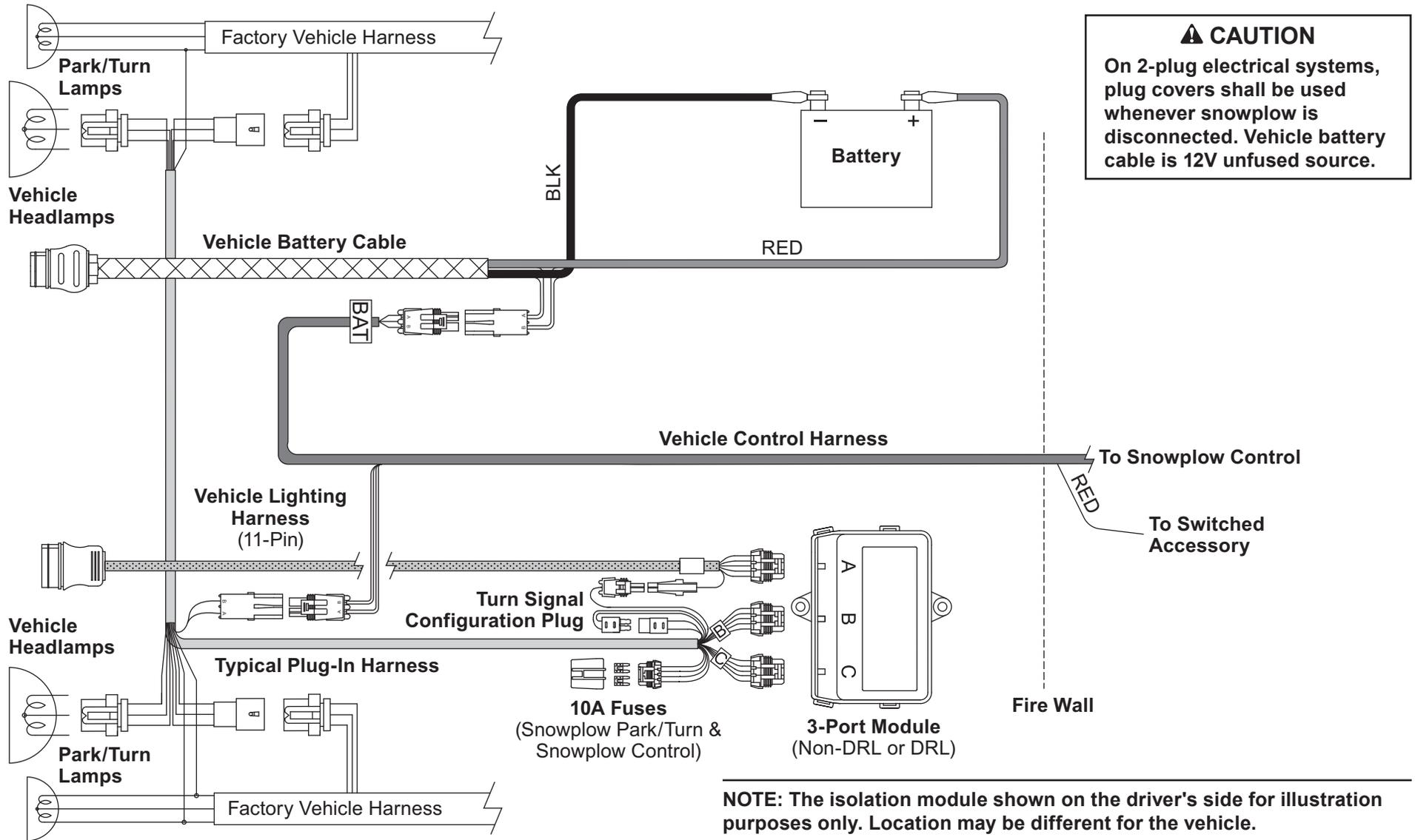
**Left Side = Driver's Side (DS)**  
**Right Side = Passenger's Side (PS)**

ELECTRICAL LEGEND		HYDRAULIC LEGEND	
	CROSSING WIRE		LINE, WORKING (MAIN)
	WIRE SPLICE		LINES JOINING
	IN-LINE CONNECTOR		LINES CROSSING
	FUSE		FLOW, DIRECTION OF HYDRAULIC FLUID
	SOLENOID COIL		LINE, TO RESERVOIR BELOW FLUID LEVEL
	CIRCUIT GROUND		HYDRAULIC PUMP FIXED DISPLACEMENT
	MOTOR RELAY		CYLINDER
	BATTERY		ELECTRIC MOTOR
	MOTOR		FILTER, STRAINER, DIFFUSER
	HEADLAMP		COMPONENT ENCLOSURE
	PARK/TURN LAMP		SPRING
	PRINTED CIRCUIT BOARD		SOLENOID, SINGLE WINDING
	COMPONENT ENCLOSURE		PILOT-OPERATED (P/O) CHECK VALVE
			VALVE, ADJUSTABLE PRESSURE RELIEF
			VALVE, FLOW CONTROL, ADJUSTABLE-NON-COMPENSATED
			VALVE, 2-POSITION, 2-CONNECTION (2-WAY)
			VALVE, 2-POSITION, 3-CONNECTION (3-WAY)
			VALVE, 2-POSITION, 4-CONNECTION (4-WAY)
			ORIFICE PLATE
			CHECK VALVE

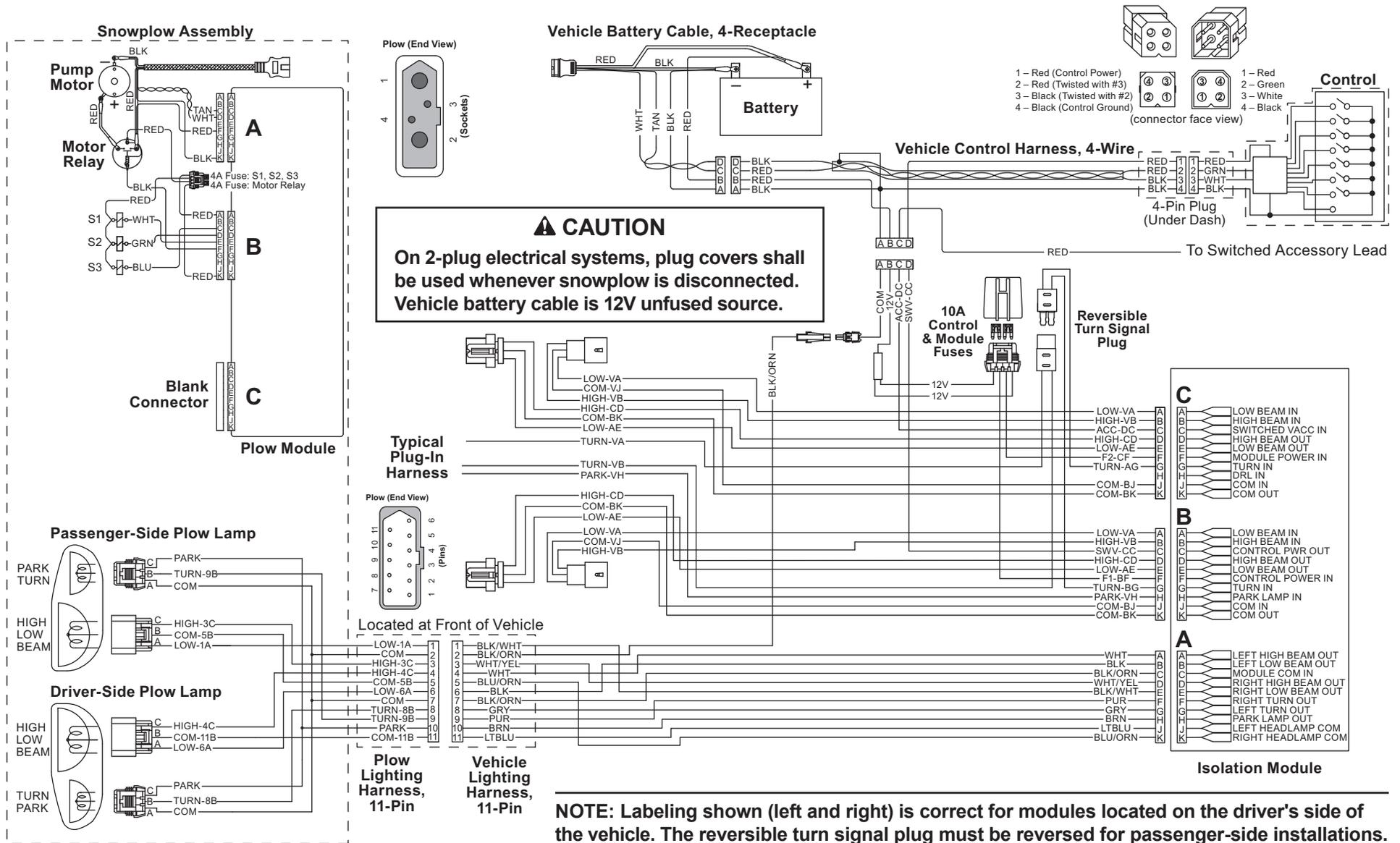
Wire Color Code				Abbreviations					
BLK	Black	BLU/ORN	Blue w/ Orange	GRY	Gray	PUR	Purple	DRL	Daytime Running Lamps
BLK/ORN	Black w/ Orange	BRN	Brown	LTBLU	Light Blue	RED	Red	MTR RLY	Motor Relay
BLK/RED	Black w/ Red	BRN/GRN	Brown w/ Green	LTGRN	Light Green	WHT	White	P/T SIG	Park / Turn Signal
BLK/WHT	Black w/ White	BRN/RED	Brown w/ Red	ORN	Orange	WHT/YEL	White w/ Yellow		
BLU	Blue	GRN	Green	PNK	Pink	YEL	Yellow		

# SYSTEM OVERVIEW – ELECTRICAL

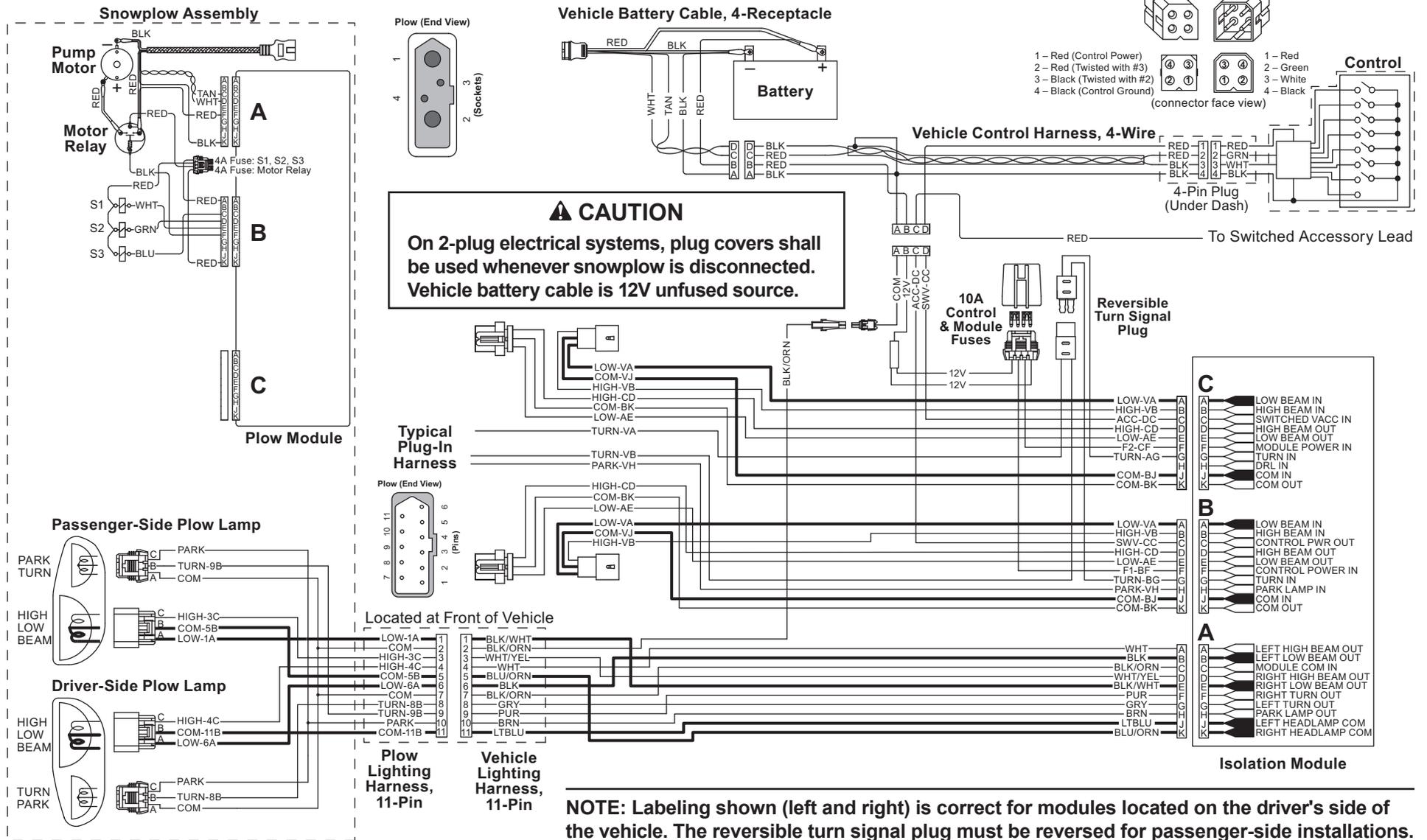
## WIRING – 3-PORT MODULE



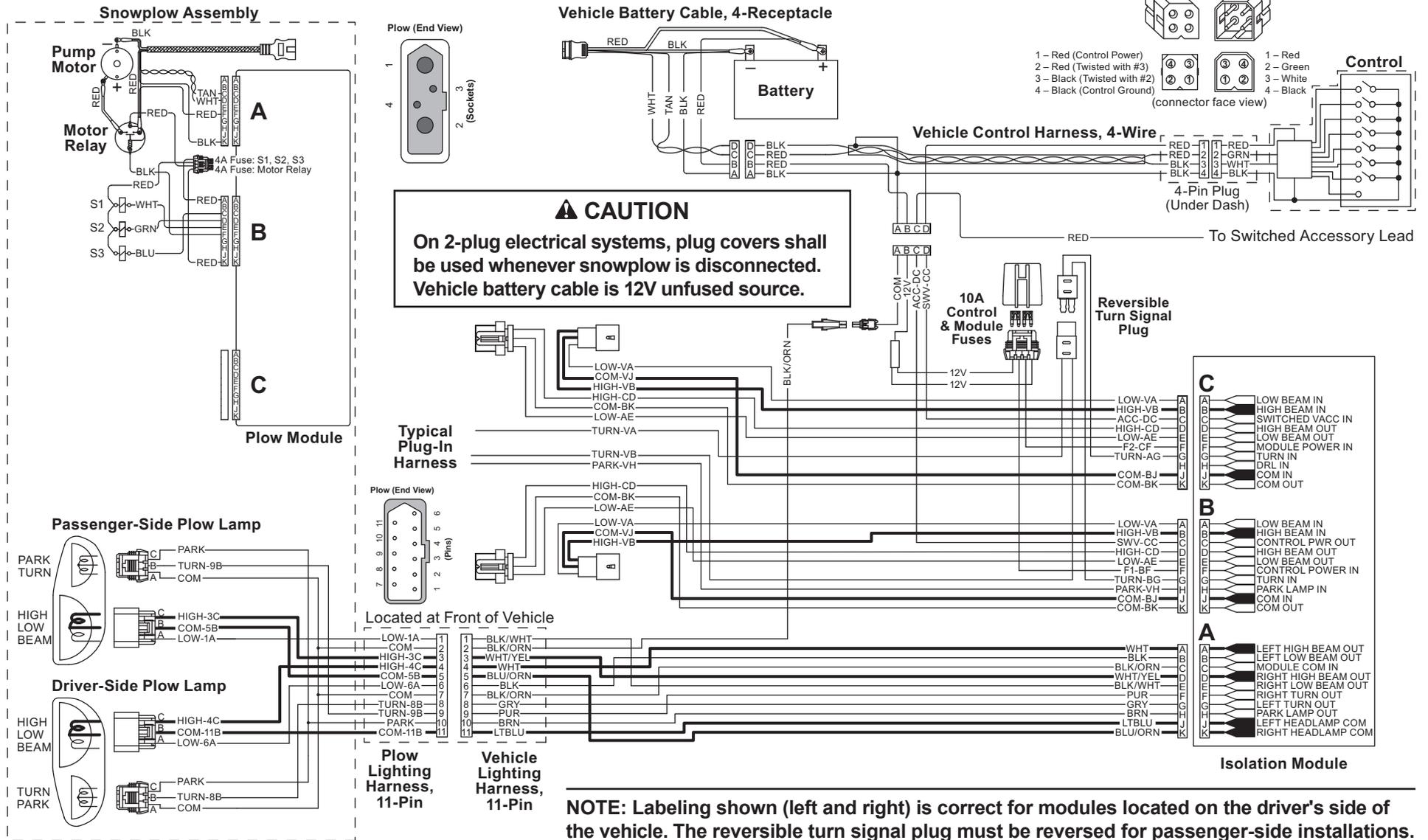
# ELECTRICAL SCHEMATIC – 3-PORT MODULE



# LOW BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (3-PORT MODULE)



# HIGH BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (3-PORT MODULE)



# THEORY OF OPERATION

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## 4-PORT MODULE ELECTRICAL

### Snowplow Headlamps

The Isolation Module acts as an electrical hub, automatically directing vehicle power to the appropriate vehicle or snowplow lighting devices, while also supplying battery power to the snowplow control.

The vehicle high and low beams enter and exit the Isolation Module through port 3 (left-side lighting) and port 4 (right-side lighting). Park, turn and DRL signals also enter through ports 3 and 4. The output of the vehicle dimmer switch is directed to the Isolation Module via the long and short plug-in harnesses.

All snowplow lighting exits the Isolation Module through port 2.

When the snowplow is not attached to the vehicle, the signal passes through the normally closed relay contacts to the vehicle headlamps. During this time, the Isolation Module is inactive, placing no current draw on the vehicle's electrical system.

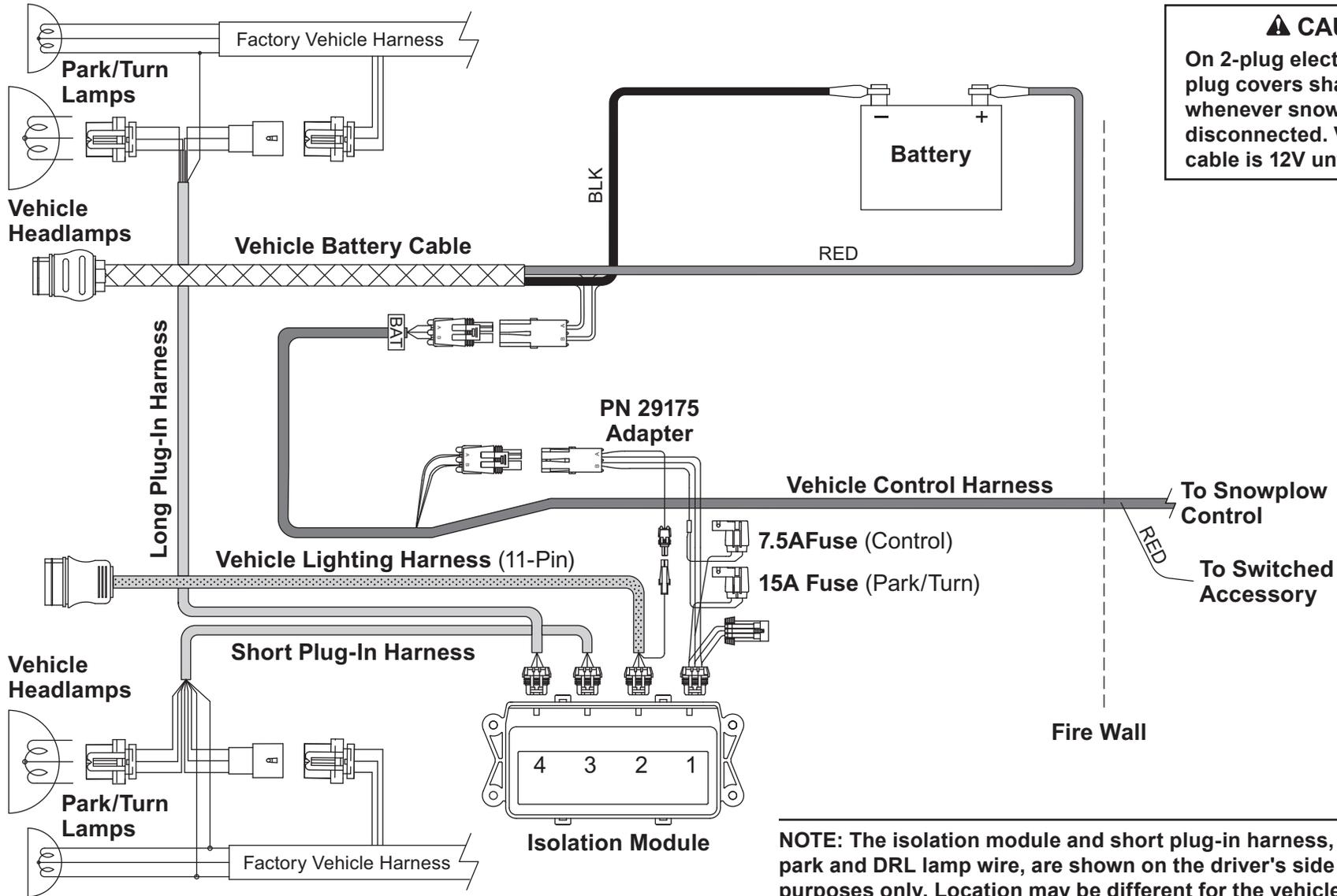
With the snowplow attached, the Isolation Module is still inactive until either of the two following conditions are met: The vehicle parking lights are turned ON or the vehicle ignition switch is turned ON.

Turning ON the vehicle parking lights activates a series of relays, automatically transferring the vehicle high and low beams to the snowplow while supplying battery power directly to the snowplow parking lights.

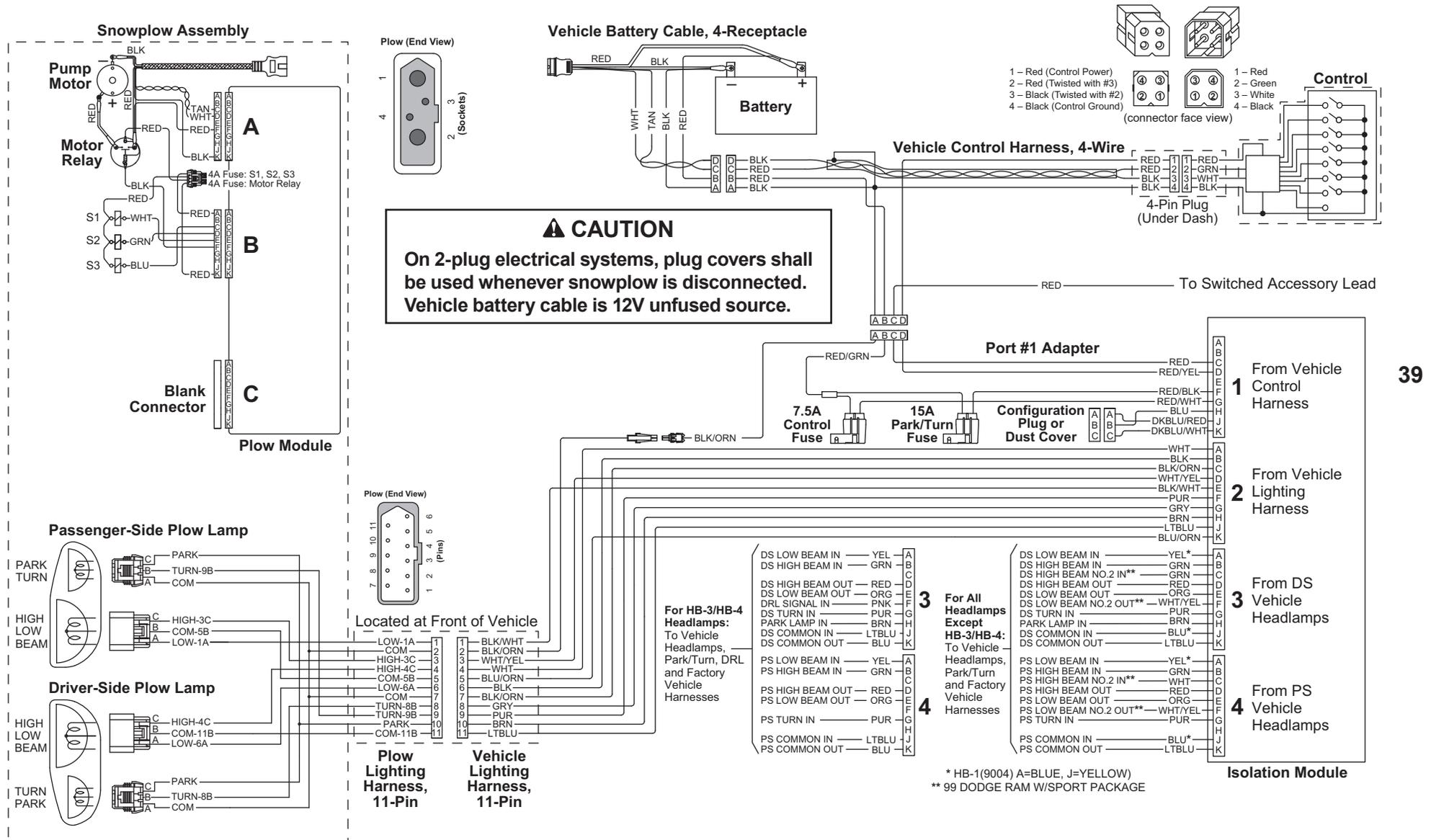
Turning ON the vehicle ignition switch energizes a snowplow control relay, supplying vehicle battery power directly to the control via the vehicle control harness. The vehicle ignition switch also supplies power to the vehicle turn signals. Activating the vehicle turn signals energizes turn signal relays, which supply vehicle battery power directly to the snowplow turn signals.

# SYSTEM OVERVIEW – ELECTRICAL

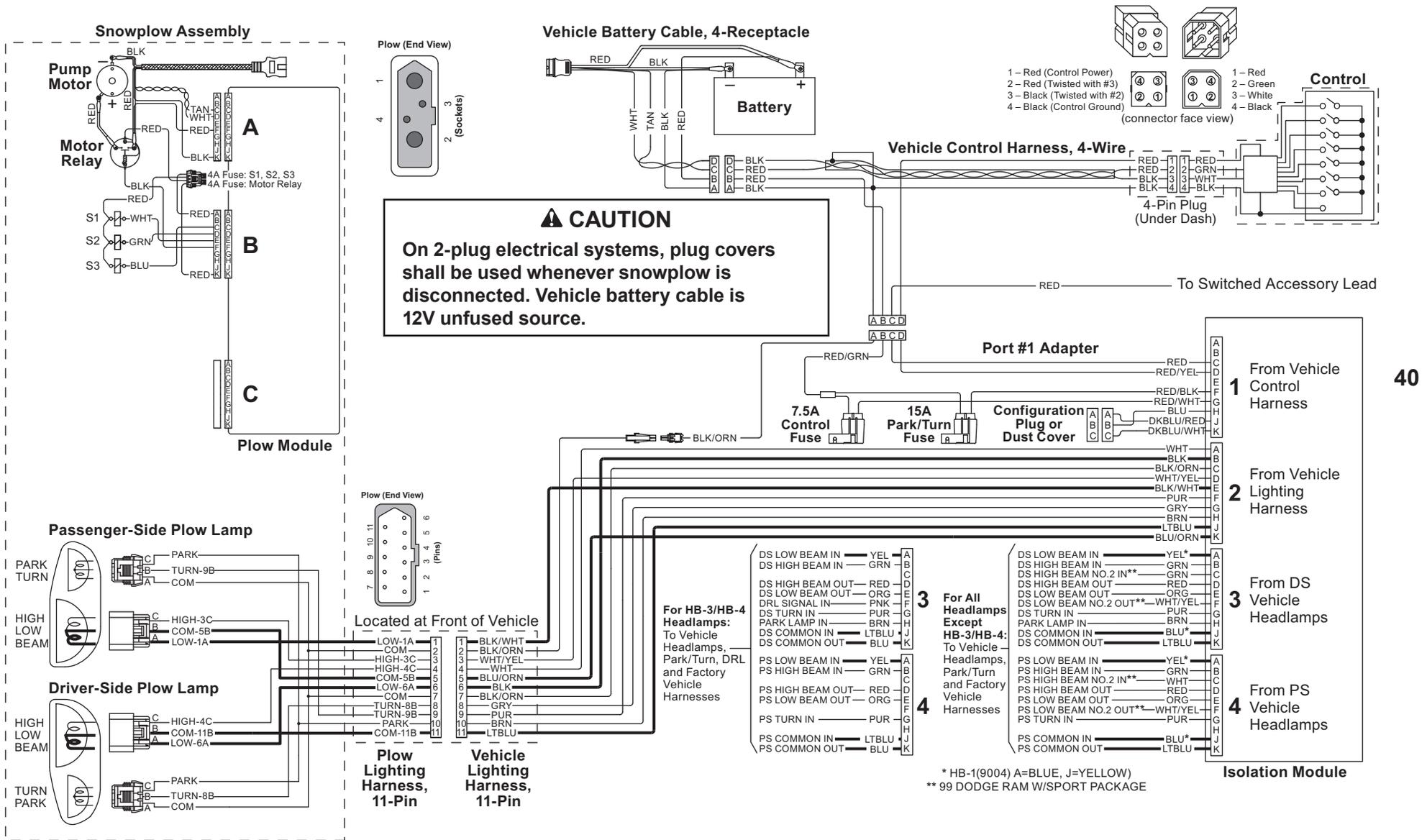
## WIRING – 4-PORT MODULE



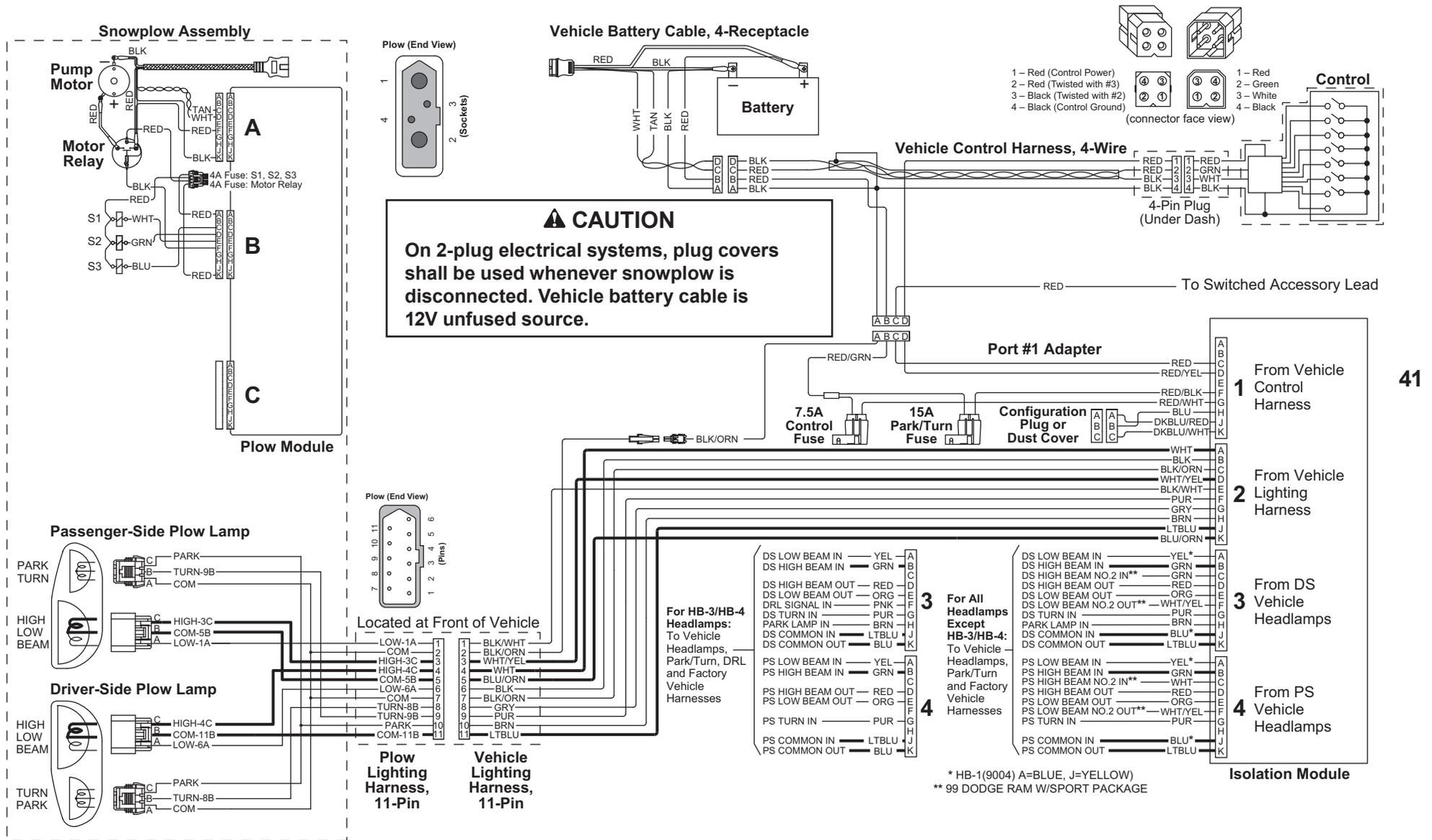
# ELECTRICAL SCHEMATIC – 4-PORT MODULE



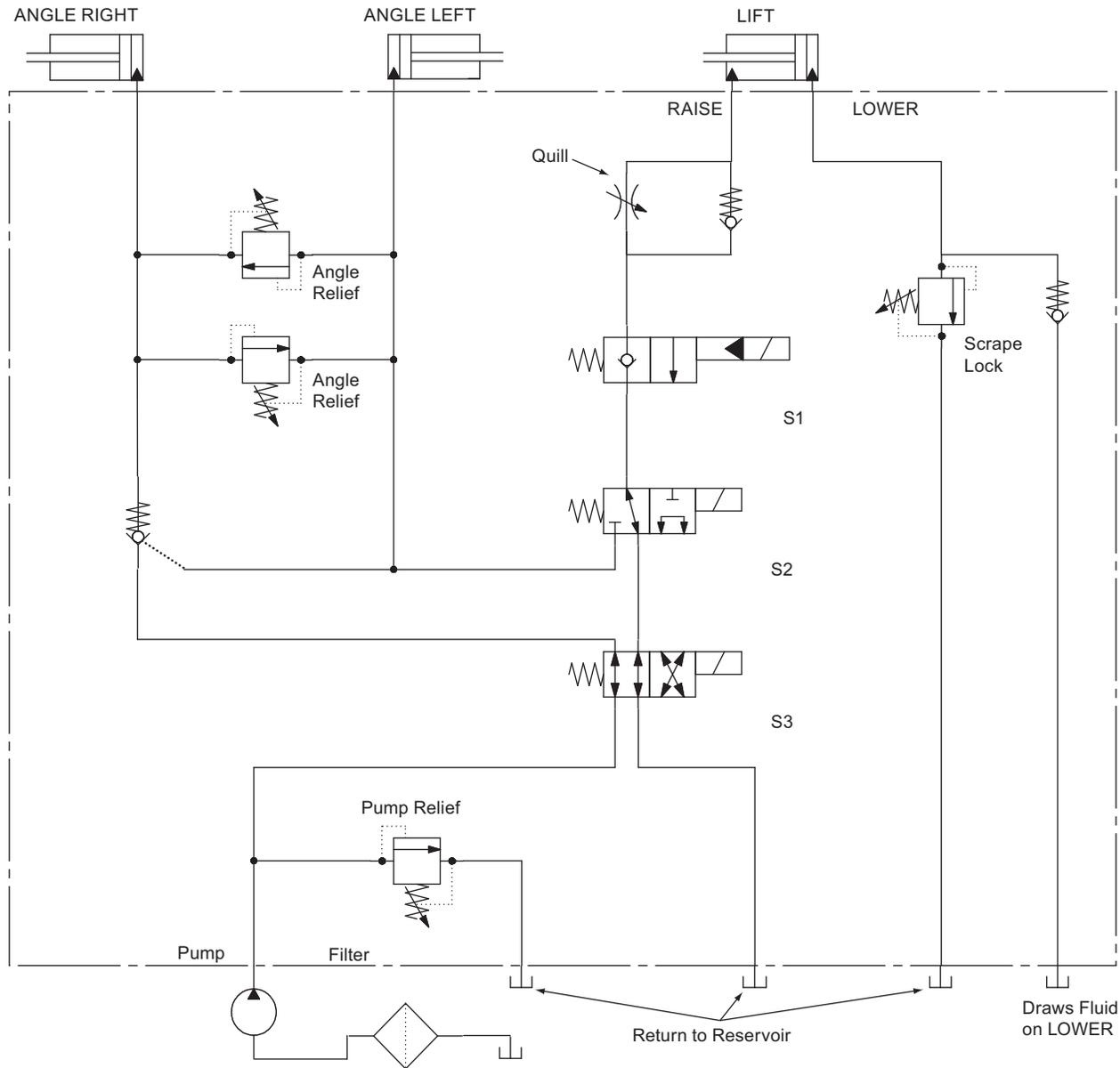
# LOW BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (4-PORT MODULE)



# HIGH BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (4-PORT MODULE)

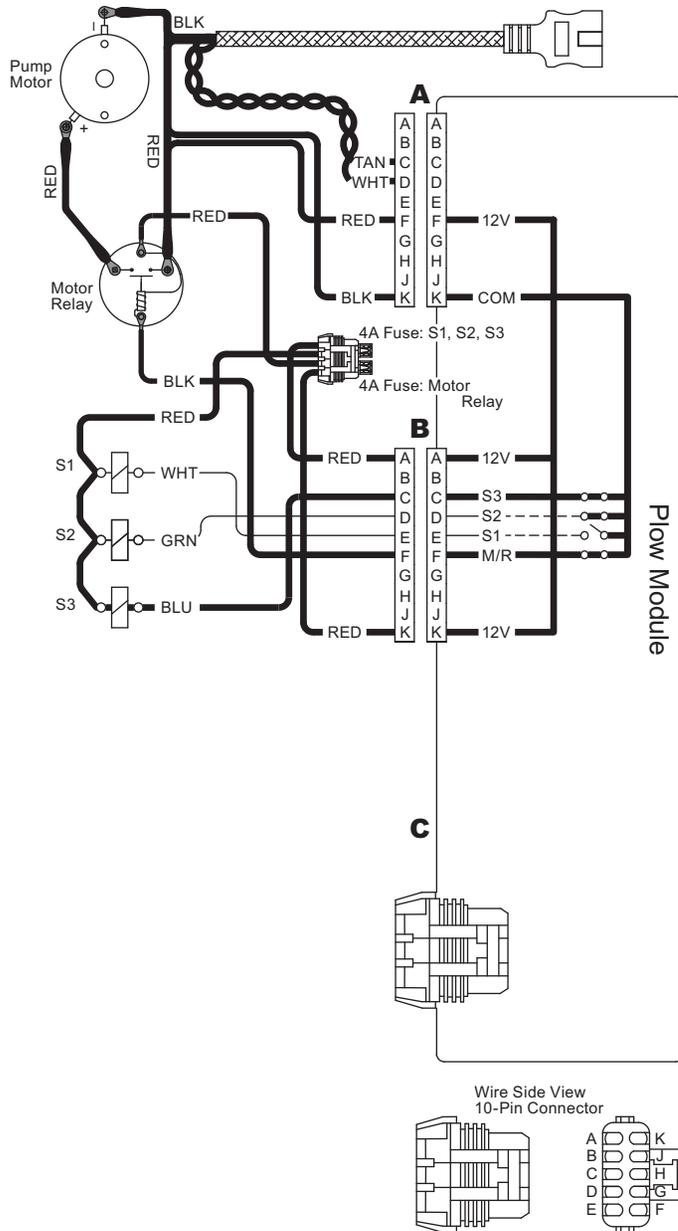


# HYDRAULIC SCHEMATIC



BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		↔	↔
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

# RAISE – ELECTRICAL

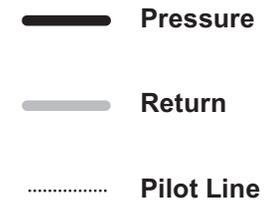
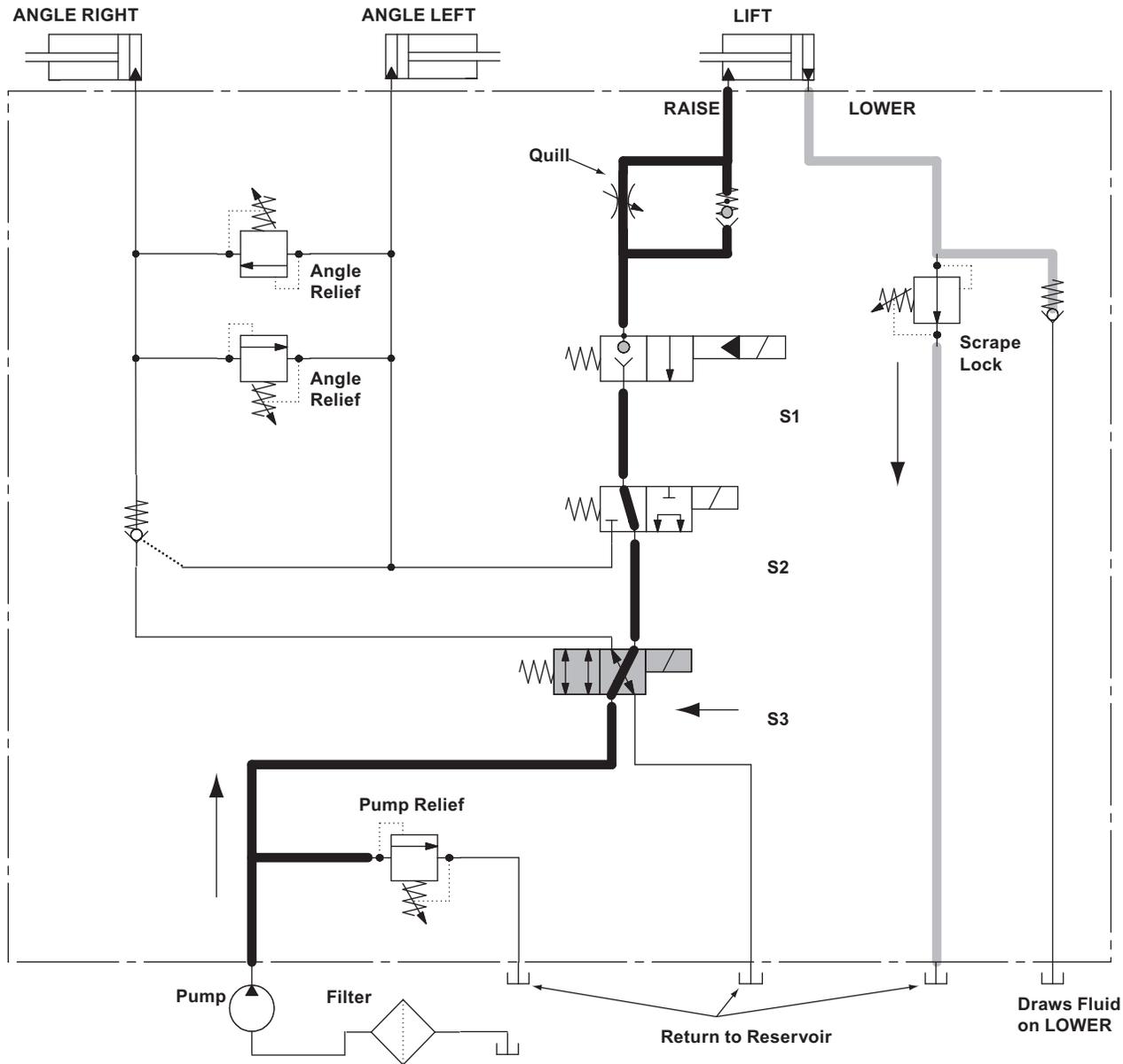


## System Response

1. By activating the RAISE function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valve S3.
2. Hydraulic fluid from the pump flows through the activated S3 and unactivated S2, through the internal check valve in S1, into the rod end of the lift ram, causing it to retract. At the same time, hydraulic fluid is being forced out of the base of the ram, through the scrape lock (RV4) relief valve, and returned to the reservoir.

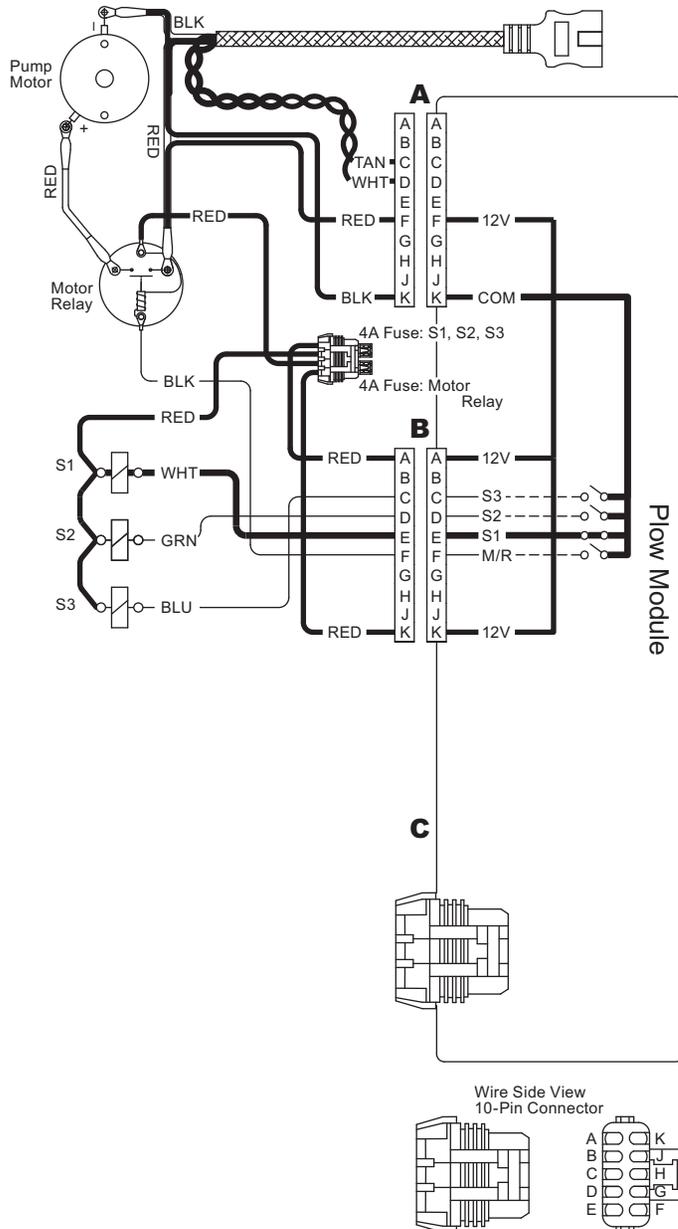
**NOTE: Battery voltage is supplied to the Plow Module, the motor relay, and the three solenoid coils when the snowplow is connected to the vehicle.**

# RAISE – HYDRAULIC



BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON			
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

## LOWER / FLOAT – ELECTRICAL



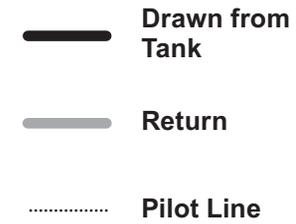
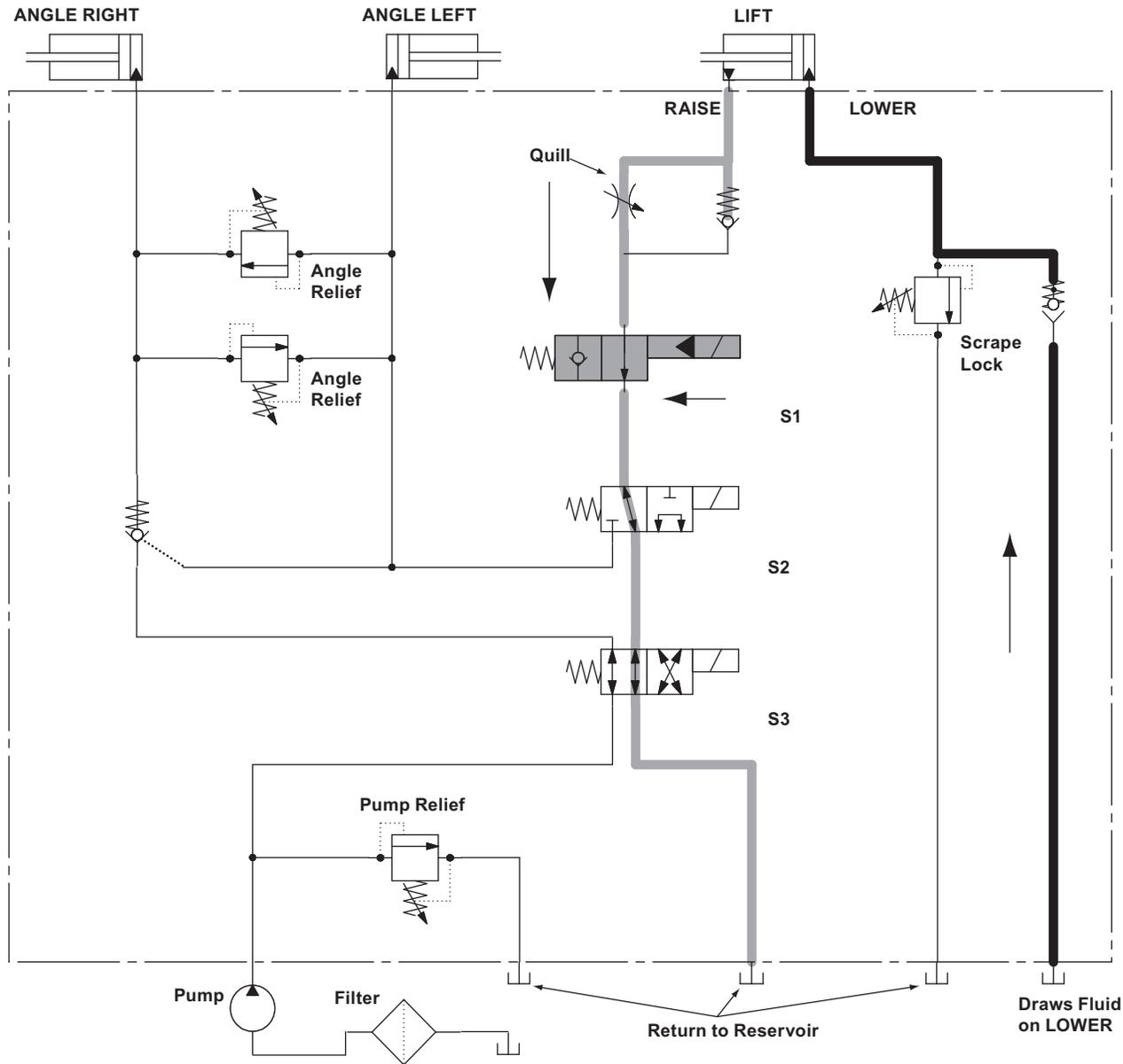
### System Response

1. By activating the LOWER function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating solenoid cartridge valve S1.
2. With the weight of the snowplow on the rod end of the lift ram and S1 cartridge valve shifted, the lift ram extends. Hydraulic fluid is pushed out of the rod end, through activated S1, unactivated S2 and S3, and back to the reservoir. At the same time, hydraulic fluid is being drawn through CV2 into the base end of the ram from the reservoir.

**NOTE:** When activating FLOAT mode, the S1 cartridge stays open until the RAISE function is activated

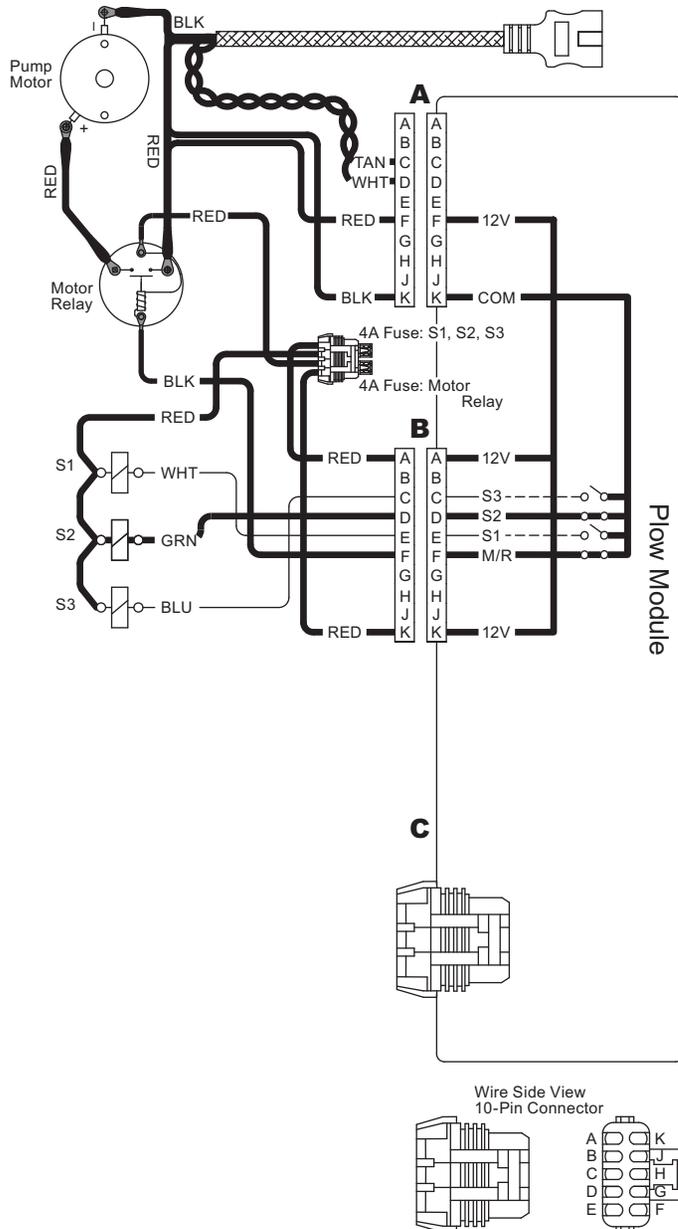
**NOTE:** Battery voltage is supplied to the Plow Module, the motor relay, and the three solenoid coils when the snowplow is connected to the vehicle.

# LOWER – HYDRAULIC



BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		↔	↔
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

# ANGLE RIGHT – ELECTRICAL

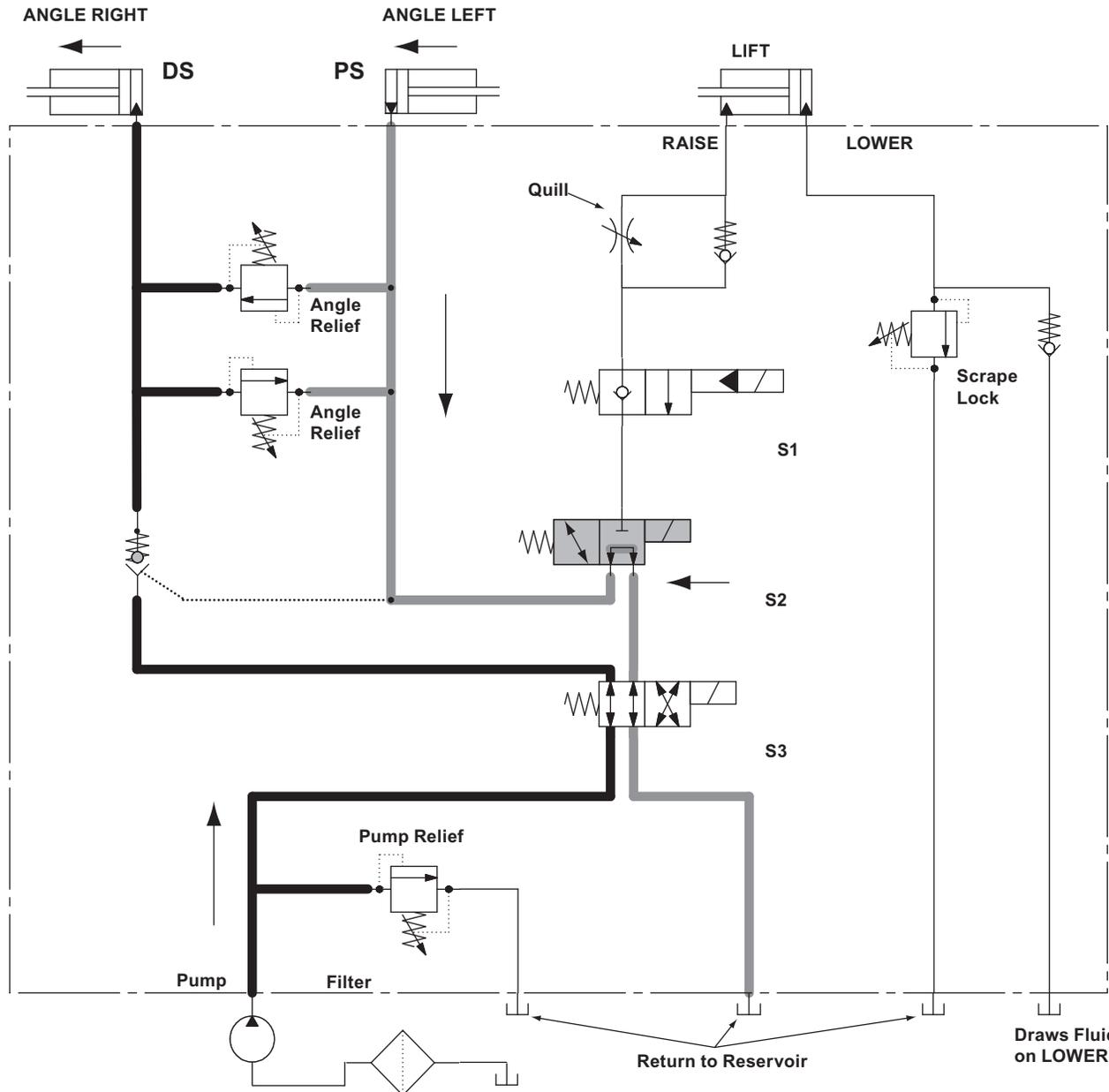


## System Response

1. By activating the angle right (**R** on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valve S2.
2. Hydraulic fluid from the pump flows through unactivated S3, through PC1, into the base of the driver-side ram, causing it to extend.
3. The retracting passenger-side ram pushes the hydraulic fluid out of its base end through the activated S2 cartridge and unactivated S3, back to the reservoir.

**NOTE: Battery voltage is supplied to the Plow Module, the motor relay, and the three solenoid coils when the snowplow is connected to the vehicle.**

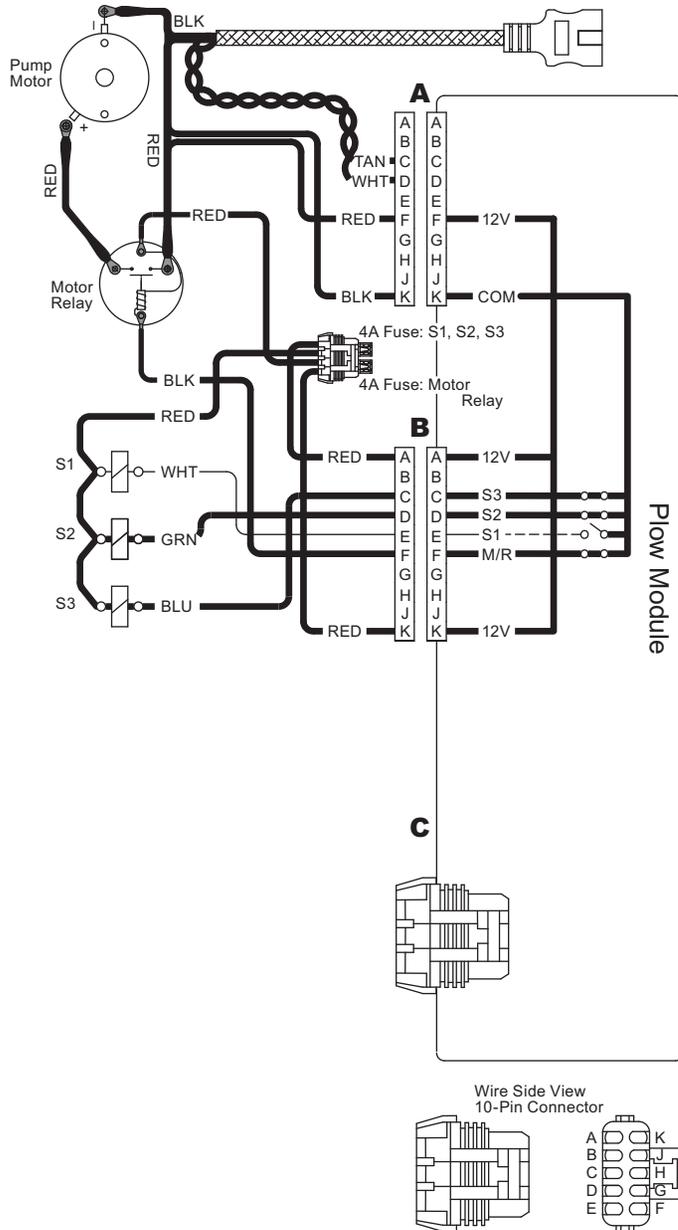
# ANGLE RIGHT – HYDRAULIC



**—** Pressure  
**—** Return  
**.....** Pilot Line

BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		↔	↔
SV08-2004	S1		ON		
SV08-31	S2			↔	↔
SV08-40	S3	ON			

# ANGLE LEFT – ELECTRICAL



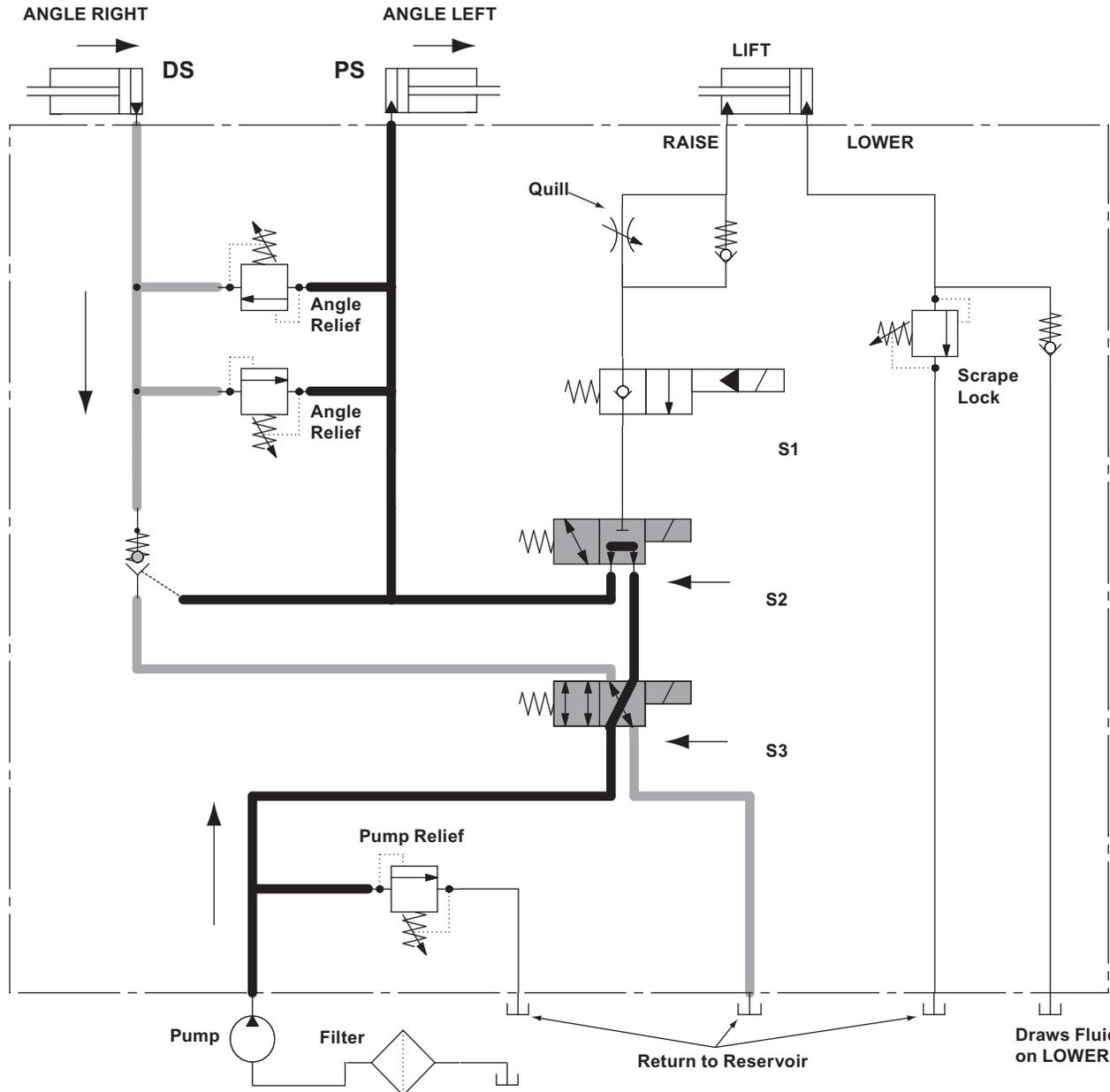
## System Response

1. By activating the angle left (L on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valves S2 and S3.
2. Hydraulic fluid from the pump flows through activated S3 and S2 and into the base end of the passenger-side ram, causing it to extend.
3. Pressure within the hydraulic circuit causes the P/O check valve (PC1) to open.
4. The retracting driver-side ram pushes the hydraulic fluid out of its base end through the open P/O check valve, through activated S3, and back to the reservoir.

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**NOTE: Battery voltage is supplied to the Plow Module, the motor relay, and the three solenoid coils when the snowplow is connected to the vehicle.**

# ANGLE LEFT – HYDRAULIC



- Pressure** (thick black line)
- Return** (thick grey line)
- Pilot Line** (dotted line)

BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		↔	↔
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

# HOLD IN RAISE POSITION – HYDRAULIC

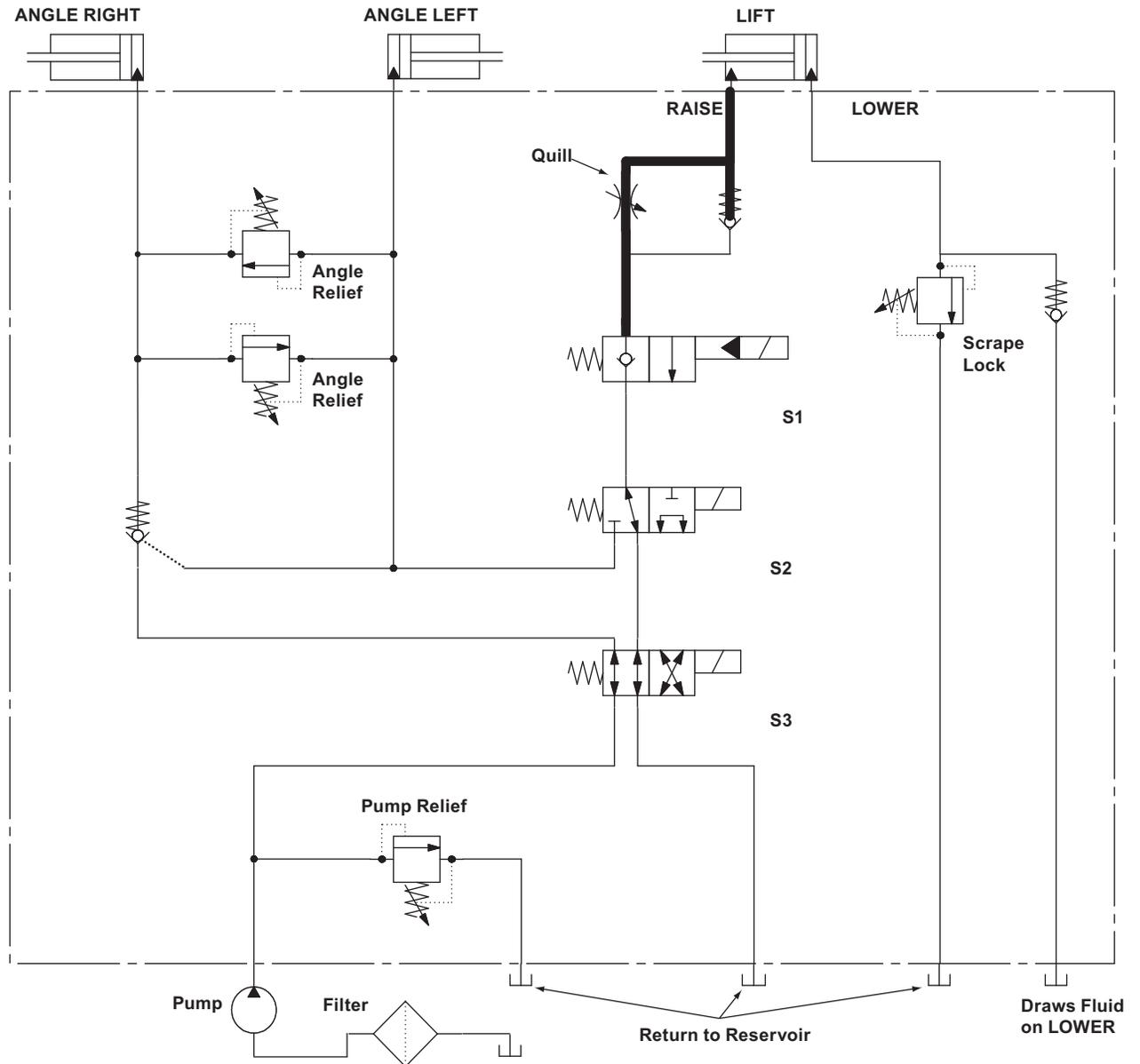
Control: None

## System Response

Hydraulic fluid is trapped in the rod end of the lift ram by the internal check valve in solenoid cartridge valves S1.

 Pressure

BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



# STRIKING AN OBJECT WHILE PLOWING

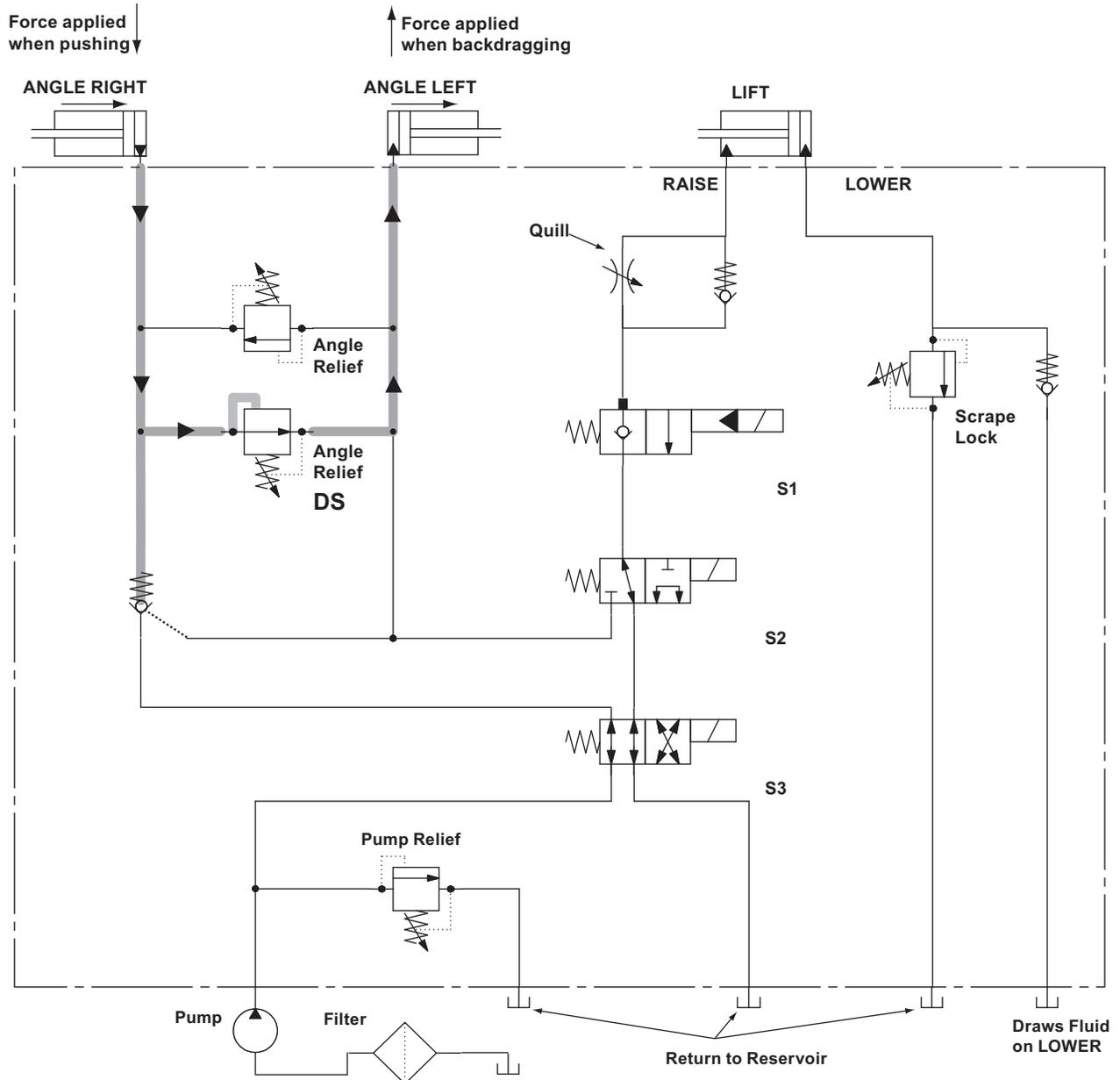
**Blade Movement:** Striking an Object While Plowing

**Control:** None

**System Response:**

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the P/O check valve (PC1), and solenoid cartridge valve S2.
2. When the snowplow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing oil to flow to the base of the opposite cylinder.

BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



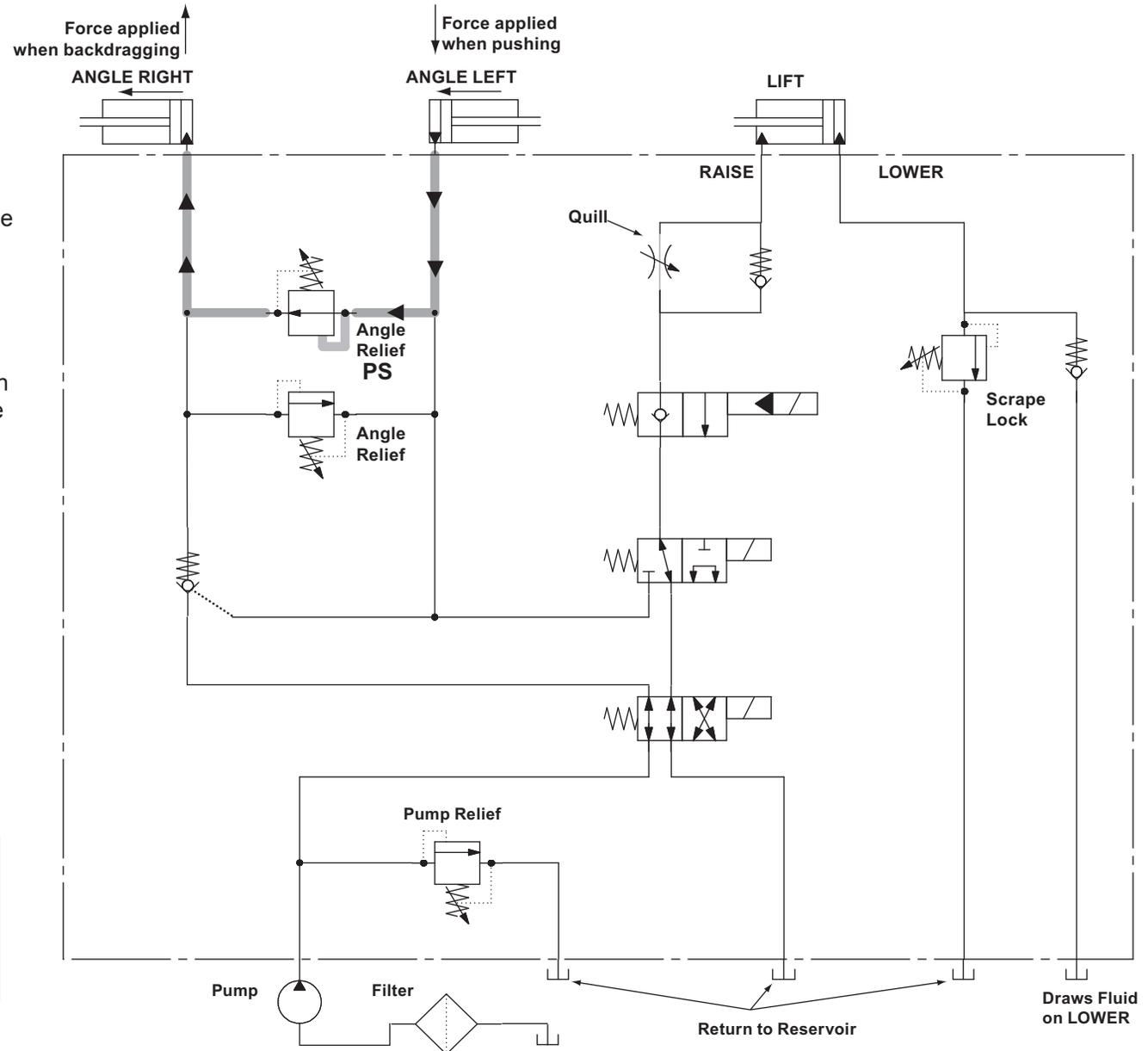
# STRIKING AN OBJECT WHILE PLOWING

**Blade Movement:** Striking an Object While Plowing

**Control:** None

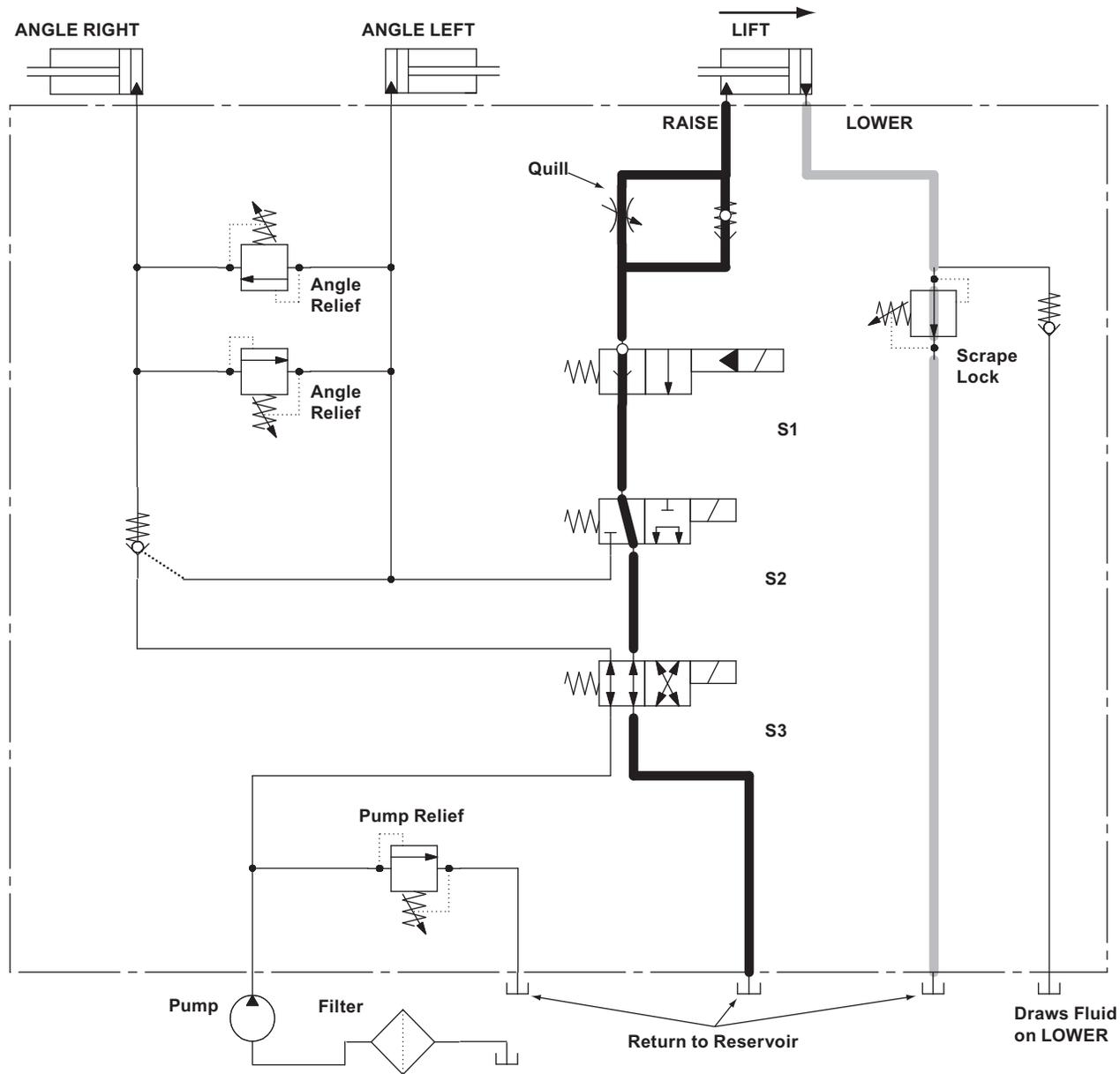
**System Response:**

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the P/O check valve (PC1), and solenoid cartridge valve S2.
2. When the snowplow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing oil to flow to the base of the opposite cylinder.



BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		↙ ↘	↘ ↙
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

# SCRAPE LOCK OPEN (ALLOWS BLADE TO RAISE, FOLLOWING SURFACE CONTOUR)



# TROUBLESHOOTING

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## INTRODUCTION

All malfunctions of the HT Series™ snowplow can be categorized as structural, electrical, or hydraulic. Structural issues are generally related to the blade, A-frame, headgear, or mount components, and are usually identified by visual inspection. However, electrical and hydraulic issues can be difficult to trace.

**Read and understand the Theory of Operation before attempting troubleshooting.**

## HOW TO USE THE TROUBLESHOOTING GUIDE

Because of the relative complexity of the snowplow electrical and hydraulic systems, some conditions must be eliminated in order to develop valid tests.

*If the listed conditions are not met, the procedure can result in inaccurate results and wasted time.*

In many cases, satisfying the listed conditions alone solves the problem.

1. Go to the Before You Begin section (next page), and satisfy the listed conditions. These conditions **must** be met before proceeding to any of the tables and tests that follow.
2. If a lighting problem exists, proceed to the proper Headlamp Troubleshooting tables for a list of basic test questions and solutions to common problems.
3. If still having problems or the problem is not related to the headlamps, go to the Hydraulic System Testing section.
4. Follow along sequentially through the tables and tests, referring to the Hydraulic & Electrical Schematics and System Overview sections as needed. Eventually the problem can be identified at the component level.

## ELECTRICAL TESTING

Read and understand the electrical circuit operation information in the Theory of Operation section. A simple 12-volt (12V) test light with a ground lead or volt meter can be used for circuit testing in most cases. The exception is the paired multiplex wiring, which carries a low level signal from the control to the Plow Module.

When directed to check for 12V, ground the test lamp lead or volt meter and probe the terminal. When asked to check for ground, attach the test lamp lead to +12V and probe the terminal.

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**NOTE: 12V is a nominal value. If using a voltmeter, actual voltage will vary with the vehicle and presence of loads in tested circuits. Continuity alone does not guarantee a good circuit. Poor connectors or damaged wires may have continuity but be unable to carry sufficient current.**

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# TROUBLESHOOTING

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## BEFORE YOU BEGIN

Before proceeding, or performing any tests, you *must* verify the following conditions:

1. **Verify** that the customer has accurately and completely described the problem. Check all lighting and snowplow functions.
2. Check the **obvious**:
  - a. Snowplow is attached to vehicle and all harnesses are connected.
  - b. Ignition is turned on or engine is running if operating control from within the cab.
  - c. The control is connected in the cab and turned on. Verify that the control power LED is in a steady state and is not flashing. Verify that the snowplow anti-theft system is unlocked.
  - d. Fuses are good.
  - e. Vehicle battery and charging system are in good condition and battery connections are clean and tight.
  - f. Harness connector pins and terminals are free of corrosion, ensuring good connections, and coated with dielectric grease.
  - g. Hydraulic reservoir is filled to proper level with recommended fluid when snowplow is in the lowered position and lift ram is fully retracted. See Product Specifications.
  - h. There are no fluid leaks from hoses, fittings, rams, or the hydraulic unit.
  - i. Hoses are routed correctly.
  - j. Coil wire connections are secure and correct.
  - k. Correct cartridges are installed in the proper locations. This step may be better left until the results of the Solenoid Coil Activation Test (SCAT) are known, unless hydraulic repair or cartridge replacement took place recently.

**⚠ CAUTION**

**Fill the reservoir to within 1" from the top of the fill hole. Do not overfill. Overfilling could damage the unit.**

**⚠ CAUTION**

**Do not mix different types of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.**

# TROUBLESHOOTING

## VEHICLE HEADLAMPS

### Incorrect Operation or No Headlamps

	BASIC CHECKS	SOLUTIONS
1	DRL mode/automatic headlamp function.	Fully understand OEM headlamp operation; refer to vehicle owner's manual.
2	Correct Isolation Module kit installed for application.	Verify per eMatch at <a href="http://www.fisherplows.com">www.fisherplows.com</a> .
3	OEM lights operating correctly prior to installation.	OEM headlamps must be fully operational for correct Isolation Module operation.
4	OEM fuse tests good.	Replace with proper fuse.
5	OEM headlamp bulb operational.	Replace with proper bulb.
6	Plugged into OEM headlamp correctly.	Connect per Isolation Module instructions.
7	Harnesses in correct location at Isolation Module and installed per installation instructions.	Install using Isolation Module instructions.
8	Harnesses configured correctly for HB-1/HB-5 and/or kits using adapters.	Install using Isolation Module instructions.
9	Configuration plug correct (only required on certain 4-Port Module installations).	Refer to Isolation Module instructions.
10	Correct harnesses and/or Isolation Module in kit.	Refer to Isolation Module parts list.
11	Harness wired per drawing.	See electrical schematics in this guide.
12	Verify power and ground in proper pin locations at Isolation Module.	See electrical schematics in this guide.
13	Verify power and ground in proper pin locations to vehicle headlamp.	See electrical schematics in this guide.
14	Test Isolation Module with Isolation Module tester.	Test using instructions supplied with tester.

# TROUBLESHOOTING

## SNOWPLOW PARK/TURN LAMPS\*

### Incorrect Operation or No Park/Turn Lamps

	BASIC CHECKS	SOLUTIONS
1	OEM park/turn lamps working.	Refer to vehicle owner's manual for fuse location and size.
2	Harnesses connected between vehicle and snowplow (all).	Harnesses must be connected for all snowplow and headlamp functions.
3	Clean harness connectors.	Replace as needed.
4	Ignition ON.	Ignition must be ON for snowplow headlamps to operate.
5	Control powers up with key ON.	Go to <b>Control/Cable/Plow Module Test</b> .
6	15A park/turn fuse good in #1 harness.	Replace with proper fuse.
7	Black/orange "ground" wire connected to motor ground stud. **	Refer to Isolation Module instructions.
8	Spliced into OEM park/turn circuit correctly.	Refer to Isolation Module instructions.
9	Harnesses in correct location at Isolation Module and installed per installation instructions.	Install using Isolation Module instructions.
10	Harness wired per drawing.	See electrical schematics in this guide.
11	Verify power and ground in proper pin locations at Isolation Module.	See electrical schematics in this guide.
12	Verify power and ground in proper pin locations to vehicle headlamp.	See electrical schematics in this guide.
13	Bulb good.	Replace with proper bulb.

\* Some applications may use the turn circuit for DRLs.

\*\* Not applicable to INTENSIFIRE™ headlamps.

# TROUBLESHOOTING

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## SNOWPLOW DRL LAMPS\*

### Incorrect Operation or No DRL Lamps

	BASIC CHECKS	SOLUTIONS
1	Fully understand OEM DRL operation.	Refer to vehicle owner's manual for DRL operation.
2	OEM headlamps and DRLs operating correctly.	OEM headlamps must be fully operational for correct Isolation Module operation.
3	OEM DRL fuse tests good.	Refer to vehicle owner's manual for fuse location and size.
4	Harnesses connected between vehicle and snowplow (all).	Harnesses must be connected for all snowplow and headlamp functions.
5	Corrosion at harness connectors.	Replace as needed.
6	Ignition ON.	Ignition must be ON for snowplow DRL operation.
7	Does control power up with key ON.	Go to <b>Control/Cable/Plow Module Test</b> .
8	Snowplow headlamp and park/turn lamps all working correctly.	See electrical schematics in this guide.
9	Correct Isolation Module kit installed for application.	Verify per eMatch at <a href="http://www.fisherplows.com">www.fisherplows.com</a> .
10	Isolation Module and harnesses correctly installed per instructions.	Refer to Isolation Module instructions.
11	Harness wired per drawing.	See electrical schematics in this guide.
12	Bulb burned out.	Replace with proper bulb.

\* Snowplow DRLs operate as a series circuit and will illuminate bulb at 1/2 intensity. In some applications, the OEM DRLs will stay illuminated with snowplow attached.

# TROUBLESHOOTING

## SOLENOID COIL ACTIVATION TEST (SCAT)

**NOTE: See the System Overview – Controls section for details on control time outs and wing functions.**

The main purpose of the SCAT is to narrow down a problem as either being electrical or hydraulic. Follow the steps below to diagnose the problem, then go to the appropriate test as directed.

1. Verify that harness B is properly attached to the solenoid coils. Refer to the labels on the hydraulic unit and the electrical schematics in this guide for details.
2. Install the Diagnostic Harness (PN 29290-2) according to the instructions on the following pages.
3. When instructed to do so, perform the SCAT by activating the control for each function and checking for magnetic pull at all three solenoid coils. A solenoid coil is magnetized if a screwdriver held nearby is attracted.

4. Compare the SCAT results with the testing charts on the following pages.

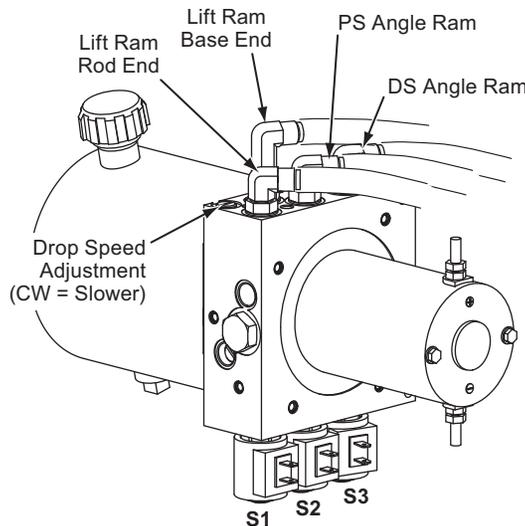
**If the motor relay LED is not activating** when it should, go to the Motor and Motor Relay Test.

**If a coil(s) is not magnetizing** when it should be, you have an electrical problem. Using a test light, check the ground wires (not red) attached to the improperly acting coil(s) for switched ground while activating the function

that should energize the coil(s). If switched ground is not present, go to the Control/Cable/Plow Module Test. If switched ground is present, go to the Individual Solenoid Coil Test.

5. **If the motor relay and all coils are working properly**, you have a hydraulic problem. Go to the Hydraulic System Test.

### Harness B Solenoid Coil Connections



Solenoid Valve	S1	S2	S3
Valve Type	2-Way	3-Way	4-Way
Wire Color	White & Red	Green & Red	Blue & Red

Plow Function	Active Coil	Active Port
Raise	S3	Lift Ram, Rod End
Lower/Float	S1	Lift Ram, Rod End
Angle Right	S2	DS Angle Ram
Angle Left	S2 & S3	PS Angle Ram

#### Torque Specifications

All Solenoid/Check Valves:	19–21 ft-lb
All Solenoid Coil Nuts:	48–60 in-lb
Motor Relay Terminals:	Small 10–15 in-lb Large 25–35 in-lb
Motor Terminals:	25–35 in-lb

# TROUBLESHOOTING

## SOLENOID COIL ACTIVATION TEST (SCAT)

**NOTE: This MUX-plow diagnostic harness kit can be used with or without the snowplow connected to a vehicle. Follow the appropriate instructions for each testing situation.**

### On-Truck Testing

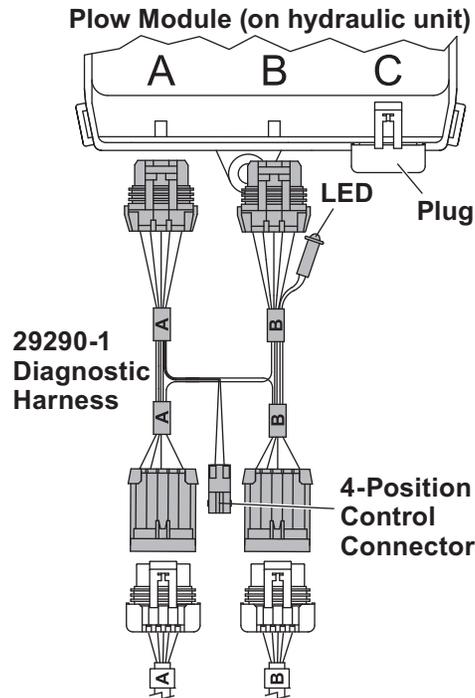
#### **⚠ WARNING**

Lower blade when vehicle is parked. Temperature changes could change hydraulic pressure, causing the blade to drop unexpectedly or damaging hydraulic components. Failure to do this could result in serious personal injury.

Remove the vehicle ignition key and put the vehicle in PARK or in gear to prevent others from starting the vehicle during testing.

1. Disconnect the snowplow and vehicle battery cables, then remove the hydraulic unit covers.
2. Unplug the snowplow connectors from ports A and B of the Plow Module.
3. Connect the diagnostic harness connectors A and B to the matching ports on the Plow Module (A to A and B to B).
4. Plug the connectors removed from the Plow Module into the matching connectors on the diagnostic harness (A to A and B to B).

5. Connect the snowplow control into the 4-position control connector either in the cab of the vehicle or on the diagnostic harness.



6. Reconnect the snowplow and vehicle battery cables.

**NOTE: If you connect the control inside the cab of the vehicle, the engine does not need to be running, but the vehicle ignition key must be turned to the "ON" position before proceeding. If you connect the control to the diagnostic harness, the key should be left out of the ignition.**

7. Turn the snowplow control ON and perform a SCAT. See the following chart for solenoid numbers and functions. See the beginning of this section for instructions on performing a SCAT.

**NOTE: The green LED on the diagnostic harness will illuminate when the motor relay function is activated. This light only tests the Plow Module's motor relay output. Refer to Motor and Motor Relay Test section for instructions on properly testing a motor relay.**

Solenoid Coil Activation Test (SCAT) Chart	
Control Function	Component(s) Activated
Raise	S3 Motor Relay
Lower	S1
Angle Right	S2, Motor Relay
Angle Left	S2, S3, Motor Relay

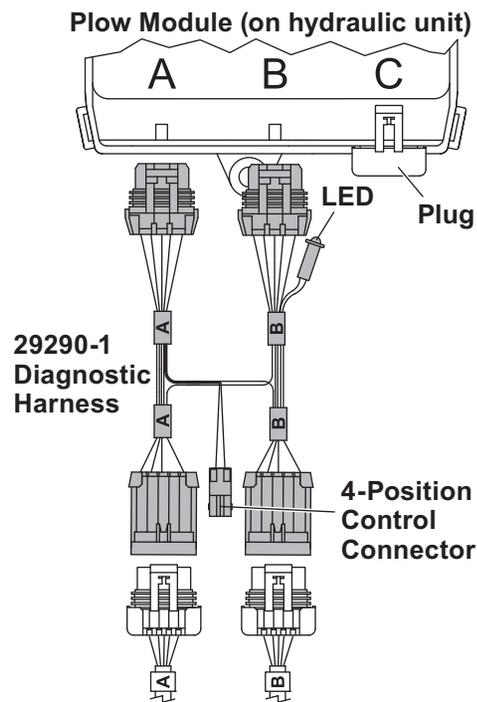
8. After completing the SCAT, turn the snowplow control and the vehicle ignition OFF, then disconnect the snowplow and vehicle battery cables.
9. Perform any required repairs and retest as needed. Make sure to disconnect the snowplow and vehicle battery cables before removing the diagnostic harness.

# TROUBLESHOOTING

## SOLENOID COIL ACTIVATION TEST (SCAT)

### Off-Truck Testing

1. Remove the hydraulic unit covers.
2. Unplug the snowplow connectors from ports A and B of the Plow Module.



3. Connect the diagnostic harness connectors A and B to the matching ports on the Plow Module (A to A and B to B).
4. Plug the connectors removed from the Plow Module into the matching connectors on the diagnostic harness (A to A and B to B).

5. Connect the snowplow control into the 4-position control connector on the diagnostic harness.
6. Connect a 12V power source to the snowplow battery cable (POSITIVE [+] 12V to the red wire and NEGATIVE [-] to the black wire). Turn ON the power source.
7. Turn the snowplow control ON and perform a Solenoid Coil Activation Test (SCAT). See the following chart for solenoid numbers and functions. See the beginning of this section for instructions on performing a SCAT.

**NOTE: The green LED on the diagnostic harness will illuminate when the motor relay function is activated. This light only tests the Plow Module's motor relay output. Refer to Motor and Motor Relay Test section for instructions on properly testing a motor relay.**

Solenoid Coil Activation Test (SCAT) Chart	
Control Function	Component(s) Activated
Raise	S3 Motor Relay
Lower	S1
Angle Right	S2, Motor Relay
Angle Left	S2, S3, Motor Relay

8. After completing the SCAT, turn the snowplow control OFF and disconnect the power source.

9. Perform any required repairs and retest as needed. Make sure to disconnect the power source before removing the diagnostic harness.

### INDIVIDUAL SOLENOID COIL TEST

1. Remove both wires from coil terminals.
2. Attach an ohmmeter across the coil terminals.
3. A reading that is not approximately 7 ohm indicates coil is damaged and must be replaced.
4. Attach an ohmmeter to one coil terminal and to the steel washer at the end of the coil.
5. A reading that is not "open" indicates that the coil has an internal short and needs to be replaced.
6. If both readings are OK (i.e., approximately 7 ohm across terminals and "open" between terminal and washer), then the coil is good.

**NOTE: A good coil will draw approximately 1.5A.**

# TROUBLESHOOTING

## CONTROL/CABLE/PLOW MODULE TEST

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Control power light is not ON.	Snowplow is not connected.	Make sure grille plugs between snowplow and truck are properly connected.
	Incomplete harness connection(s) or damaged harness(es).	With the vehicle switched accessory ON, test the 4-pin connector inside the cab. If pin 1 does not have 12V and/or if pin 4 does not have ground, use the electrical schematic in this guide to trace the wires from the connector back to their source. Look for incomplete connections or damaged wires. Complete connections or repair/replace damaged wires and harnesses as needed.
	Single-pin connector on vehicle plow lighting harness is not connected.	Make sure single-pin connector on vehicle plow lighting harness is properly connected.
	Harnesses connected to Isolation Module incorrectly.	Using the electrical schematic in this guide, verify that Isolation Module and harnesses are properly connected.
	Control fuse is blown.	Replace all blown fuses in under-hood electrical harnesses.
Control power light is blinking (slow flash).	Poor connection between control and module, damaged control, or damaged Plow Module.	Make sure all plugs (control, between the snowplow and truck, on the snowplow, etc.) are properly connected.
		Check continuity of twisted pair wiring between control connector and Plow Module connector.
		If all plugs are properly connected, install a properly working control. If problem is corrected, replace PC board and/or coiled cord in damaged control.
		If problem is not corrected with properly working control, replace Plow Module.
Control power light is blinking (fast).	Snowplow is locked.	Enter 4-digit security code to unlock snowplow.
	Harnesses connected to Isolation Module incorrectly.	Using the electrical schematic in this guide, verify that Isolation Module harnesses are properly connected.
Control power light is ON, but snowplow does not respond.	Blown fuse or damaged Plow Module.	Replace all blown fuses on truck and snowplow.
		If fuses are all okay, check for 12V at all coils and primary terminal of motor relay. If 12V is missing from any coil or relay, replace Plow Module. If 12V is present, go to next Possible Cause.
	Damaged harness(es) or cable(s).	Perform a Solenoid Coil Activation Test (SCAT) according to the instructions in this guide. Replace/repair any damaged harnesses and cables.
	Damaged control or Plow Module.	Install a properly working control. If problem is corrected, replace PC board and/or coiled cord in damaged control.
		If problem is not corrected with properly working control, replace Plow Module.

### To Safely Handle PC Board:

**⚠ CAUTION**

**Circuit board may be damaged by static electricity. Always touch ground before handling PC board.**

Before disassembling control and touching the PC board, be sure to remove any static charge from yourself. Static charge can build up as a technician works on the control. Best practice is to work at a properly grounded work station with a grounded wrist strap attached to the technician. In place of proper work station, the technician should work in an oil and solvent free area and touch a good ground each time before touching the PC board while servicing the unit.

Handle the PC board by the edges only.

Do not touch the carbon (black) areas of the keypad. Your skin oils will deteriorate the contact area.



# TROUBLESHOOTING

## PUMP PRESSURE TEST

### ⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered, or angled. Do not stand between the vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

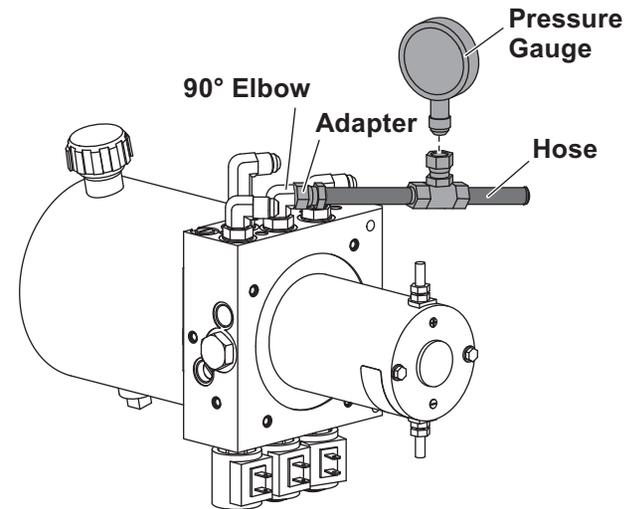
**NOTE: Reservoir will contain residual pressure. Slowly remove, then reinstall, breather to release pressure before proceeding.**

1. Verify proper fluid level before beginning test.
2. Relieve pressure in system using test harness and operating all snowplow functions.
3. Attach a 3000 psi hydraulic pressure gauge to the passenger-side ram by teeing into the line.
4. Activate the left angle function until blade is fully angled.

**NOTE: Control will time out after 9.6 seconds. Repeat command if blade is not fully angled.**

5. Repeat the left angle function, and read the pressure shown on the gauge.
6. Refer to the following table.

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
<b>Pump pressure is below 1650 ± 50 psi</b>	Pump Relief Valve	Pump relief valve may be out of adjustment. Turn relief valve clockwise 1/4 turn and retest pressure. Repeat until correct pressure (1650 ± 50 psi) is obtained. If correct pressure is not obtained after readjustment, remove and inspect the relief valve and its components. Check O-ring, stem, and ball for wear or damage. Reseat ball or replace relief valve as needed. Reinstall/replace and readjust valve, then retest pump pressure.
	O-Ring (between pump and valve block)	Remove the pump and inspect the O-ring between the pump and the valve block for damage. Reinstall/replace O-ring and pump, then retest pump pressure.
	Pump	Remove the pump and inspect it for wear or broken gears. Replace pump if needed, adjust pump relief valve, then retest pressure.
<b>Motor slow/plow functions slow</b>	Motor draws more than 100A at pump relief.	Replace the motor.



# TROUBLESHOOTING

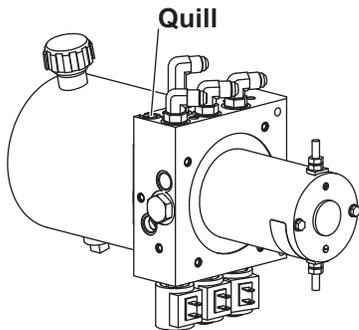
## BLADE DROP SPEED ADJUSTMENT

### **⚠ WARNING**

Keep 8' clear of the blade when it is being raised, lowered, or angled. Do not stand between the vehicle and blade or directly in front of blade. If the blade hits or drops on you, you could be seriously injured.

The quill in the valve manifold adjusts the blade drop speed.

1. Lower the blade to the ground before making adjustment.
2. Turn the quill IN (clockwise) to decrease drop speed. Turn the quill OUT (counterclockwise) to increase drop speed.



### Fluid Level

### **⚠ CAUTION**

Do not mix different kinds of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage

**NOTE: Remove fill plug slowly to relieve and pressure in reservoir.**

With Minute Mount® 2 system attached to the vehicle, activate control and lower the blade to the ground. Turn control OFF. Remove the filler/breather plug.

Fill reservoir to within 2-1/2" from the top of the fill hole and replace fill plug.

For hydraulic fluid type and filling instructions, see Hydraulic System, Annual Fluid Change, in the Maintenance section of the Owner's Manual.





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